



SEMiX® 5

3-Level NPC IGBT-Module

SEMiX155MLI07E4

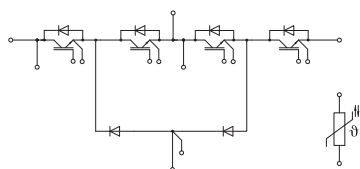
Target Data

Features

- Solderless assembling solution with PressFIT signal pins and screw power terminals
- IGBT 4 Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

Remarks*

- Case temperature limited to $T_C=125^\circ\text{C}$ max
- Product reliability results are valid for $T_{jop}=150^\circ\text{C}$
- IGBT1 : outer IGBTs T1 & T4
- IGBT2 : inner IGBTs T2 & T3
- Diode1 : outer diodes D1 & D4
- Diode2 : inner diodes D2 & D3
- Diode5 : clamping diodes D5 & D6
- For storage and case temperature with TIM see document "TP(HALA P8) SEMiX 5p"



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| Absolute Maximum Ratings | | | |
|--------------------------|--|--------------------------|------------------|
| Symbol | Conditions | Values | Unit |
| IGBT1 | | | |
| V_{CES} | $T_j = 25^\circ\text{C}$ | 650 | V |
| I_C | $T_j = 175^\circ\text{C}$ | $T_c = 25^\circ\text{C}$ | 187 |
| | | $T_c = 80^\circ\text{C}$ | 141 |
| I_{Cnom} | | 150 | A |
| I_{CRM} | $I_{CRM} = 3 \times I_{Cnom}$ | 450 | A |
| V_{GES} | | -20 ... 20 | V |
| t_{psc} | $V_{CC} = 360\text{ V}, V_{GE} \leq 15\text{ V}, T_j = 150^\circ\text{C}, V_{CES} \leq 650\text{ V}$ | 10 | μs |
| T_j | | -40 ... 175 | $^\circ\text{C}$ |
| IGBT2 | | | |
| V_{CES} | $T_j = 25^\circ\text{C}$ | 650 | V |
| I_C | $T_j = 175^\circ\text{C}$ | $T_c = 25^\circ\text{C}$ | 187 |
| | | $T_c = 80^\circ\text{C}$ | 141 |
| I_{Cnom} | | 150 | A |
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| T_j | | -40 ... 175 | $^\circ\text{C}$ |
| Diode1 | | | |
| V_{RRM} | $T_j = 25^\circ\text{C}$ | 650 | V |
| I_F | $T_j = 175^\circ\text{C}$ | $T_c = 25^\circ\text{C}$ | 145 |
| | | $T_c = 80^\circ\text{C}$ | 107 |
| I_{Fnom} | | 100 | A |
| I_{FRM} | $I_{FRM} = 2 \times I_{Fnom}$ | 200 | A |
| I_{FSM} | 10 ms, sin 180°, $T_j = 25^\circ\text{C}$ | 820 | A |
| T_j | | -40 ... 175 | $^\circ\text{C}$ |
| Diode2 | | | |
| V_{RRM} | $T_j = 25^\circ\text{C}$ | 650 | V |
| I_F | $T_j = 175^\circ\text{C}$ | $T_c = 25^\circ\text{C}$ | 145 |
| | | $T_c = 80^\circ\text{C}$ | 107 |
| I_{Fnom} | | 100 | A |
| I_{FRM} | $I_{FRM} = 2 \times I_{Fnom}$ | 200 | A |
| I_{FSM} | 10 ms, sin 180°, $T_j = 25^\circ\text{C}$ | 820 | A |
| T_j | | -40 ... 175 | $^\circ\text{C}$ |
| Diode5 | | | |
| V_{RRM} | $T_j = 25^\circ\text{C}$ | 650 | V |
| I_F | $T_j = 175^\circ\text{C}$ | $T_c = 25^\circ\text{C}$ | 145 |
| | | $T_c = 80^\circ\text{C}$ | 107 |
| I_{Fnom} | | 100 | A |
| I_{FRM} | $I_{FRM} = 2 \times I_{Fnom}$ | 200 | A |
| I_{FSM} | 10 ms, sin 180°, $T_j = 25^\circ\text{C}$ | 820 | A |
| T_j | | -40 ... 175 | $^\circ\text{C}$ |
| Module | | | |
| $I_t(\text{RMS})$ | | 300 | A |
| T_{stg} | module without TIM | -40 ... 125 | $^\circ\text{C}$ |
| V_{isol} | AC sinus 50Hz, $t = 1\text{ min}$ | 4000 | V |



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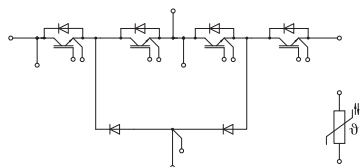
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MLI

| Characteristics | | | | | | | |
|-----------------|--|---------------------------|------|------|------|------------|----|
| Symbol | Conditions | | min. | typ. | max. | Unit | |
| IGBT1 | | | | | | | |
| $V_{CE(sat)}$ | $I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | | 1.55 | 1.95 | V | |
| | | $T_j = 150^\circ\text{C}$ | | 1.75 | 2.15 | V | |
| V_{CE0} | chipelevel | $T_j = 25^\circ\text{C}$ | | 0.90 | 1.00 | V | |
| | | $T_j = 150^\circ\text{C}$ | | 0.82 | 0.90 | V | |
| r_{CE} | $V_{GE} = 15\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | | 4.3 | 6.3 | m Ω | |
| | | $T_j = 150^\circ\text{C}$ | | 6.2 | 8.3 | m Ω | |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}, I_C = 4\text{ mA}$ | | 5.1 | 5.8 | 6.4 | V | |
| I_{CES} | $V_{GE} = 0\text{ V}, V_{CE} = 650\text{ V}, T_j = 25^\circ\text{C}$ | | | | - | mA | |
| C_{ies} | $V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$ | $f = 1\text{ MHz}$ | | 9.2 | | nF | |
| C_{oes} | | $f = 1\text{ MHz}$ | | 0.58 | | nF | |
| C_{res} | | $f = 1\text{ MHz}$ | | 0.27 | | nF | |
| Q_G | $V_{GE} = -15\text{ V} \dots +15\text{ V}$ | | | 1200 | | nC | |
| R_{Gint} | $T_j = 25^\circ\text{C}$ | | | 2.0 | | Ω | |
| $t_{d(on)}$ | $I_C = 100\text{ A}$ $V_{GE} = +15/-15\text{ V}$ | | | | | ns | |
| t_r | | | | | | ns | |
| E_{on} | | | | | 1 | | mJ |
| $t_{d(off)}$ | | | | | | | ns |
| t_f | | | | | | | ns |
| E_{off} | | | | | 6 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | | 0.32 | K/W | |
| $R_{th(c-s)}$ | per IGBT ($\lambda_{grease}=0.81\text{ W}/(\text{m}^*\text{K})$) | | | 0.07 | | K/W | |
| $R_{th(c-s)}$ | per IGBT, pre-applied phase change material | | | TBD | | K/W | |
| IGBT2 | | | | | | | |
| $V_{CE(sat)}$ | $I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | | 1.55 | 1.95 | V | |
| | | $T_j = 150^\circ\text{C}$ | | 1.75 | 2.15 | V | |
| V_{CE0} | chipelevel | $T_j = 25^\circ\text{C}$ | | 0.90 | 1.00 | V | |
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| I_{CES} | $V_{GE} = 0\text{ V}, V_{CE} = 650\text{ V}, T_j = 25^\circ\text{C}$ | | | | - | mA | |
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| $t_{d(on)}$ | $I_C = 100\text{ A}$ $V_{GE} = +15/-15\text{ V}$ | | | | | ns | |
| t_r | | | | | | ns | |
| E_{on} | | | | | 1 | | mJ |
| $t_{d(off)}$ | | | | | | | ns |
| t_f | | | | | | | ns |
| E_{off} | | | | | 6 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | | 0.32 | K/W | |
| $R_{th(c-s)}$ | per IGBT ($\lambda_{grease}=0.81\text{ W}/(\text{m}^*\text{K})$) | | | 0.07 | | K/W | |
| $R_{th(c-s)}$ | per IGBT, pre-applied phase change material | | | TBD | | K/W | |



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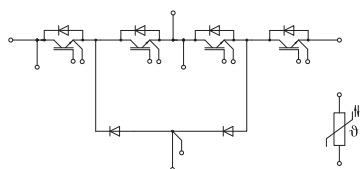
Features

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- IGBT 4 Trench Gate Technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Reliable mechanical design with injection moulded terminals and reliable internal connections
- UL recognized file no. E63532
- NTC temperature sensor inside

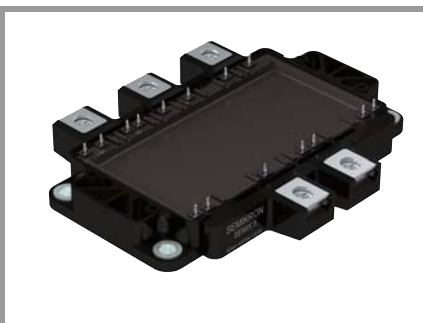
Remarks*

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- IGBT1 : outer IGBTs T1 & T4
- IGBT2 : inner IGBTs T2 & T3
- Diode1 : outer diodes D1 & D4
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- Diode5 : clamping diodes D5 & D6
- For storage and case temperature with TIM see document "TP(HALA P8) SEMiX 5p"

| Characteristics | | | | | | |
|-----------------|---|---------------------------|------|------|------|---------------|
| Symbol | Conditions | | min. | typ. | max. | Unit |
| Diode1 | | | | | | |
| $V_F = V_{EC}$ | $I_F = 100\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | | 1.40 | 1.76 | V |
| | | $T_j = 150^\circ\text{C}$ | | 1.38 | 1.77 | V |
| V_{F0} | chipelevel | $T_j = 25^\circ\text{C}$ | | 1.04 | 1.24 | V |
| | | $T_j = 150^\circ\text{C}$ | | 0.85 | 0.99 | V |
| r_F | chipelevel | $T_j = 25^\circ\text{C}$ | | 3.6 | 5.3 | m Ω |
| | | $T_j = 150^\circ\text{C}$ | | 5.3 | 7.8 | m Ω |
| I_{RRM} | $I_F = 100\text{ A}$ | | | - | | A |
| Q_{rr} | | | | - | | μC |
| E_{rr} | $V_{GE} = +15/-15\text{ V}$ | | | 2.25 | | mJ |
| $R_{th(j-c)}$ | per diode | | | | 0.51 | K/W |
| $R_{th(c-s)}$ | per diode ($\lambda_{grease}=0.81\text{ W}/(\text{m}^*\text{K})$) | | | 0.12 | | K/W |
| $R_{th(c-s)}$ | per diode, pre-applied phase change material | | | TBD | | K/W |
| Diode2 | | | | | | |
| $V_F = V_{EC}$ | $I_F = 100\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel | $T_j = 25^\circ\text{C}$ | | 1.40 | 1.76 | V |
| | | $T_j = 150^\circ\text{C}$ | | 1.38 | 1.77 | V |
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| $R_{th(c-s)}$ | per diode, pre-applied phase change material | | | TBD | | K/W |
| Diode5 | | | | | | |
| $V_F = V_{EC}$ | $I_F = 100\text{ A}$ chipelevel | $T_j = 25^\circ\text{C}$ | | 1.40 | 1.76 | V |
| | | $T_j = 150^\circ\text{C}$ | | 1.38 | 1.77 | V |
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| Q_{rr} | | | | | | μC |
| E_{rr} | $V_{GE} = +15/-15\text{ V}$ | | | 3 | | mJ |
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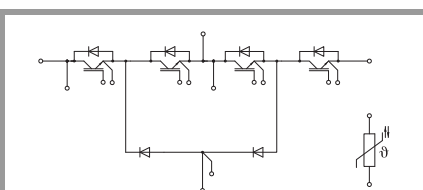
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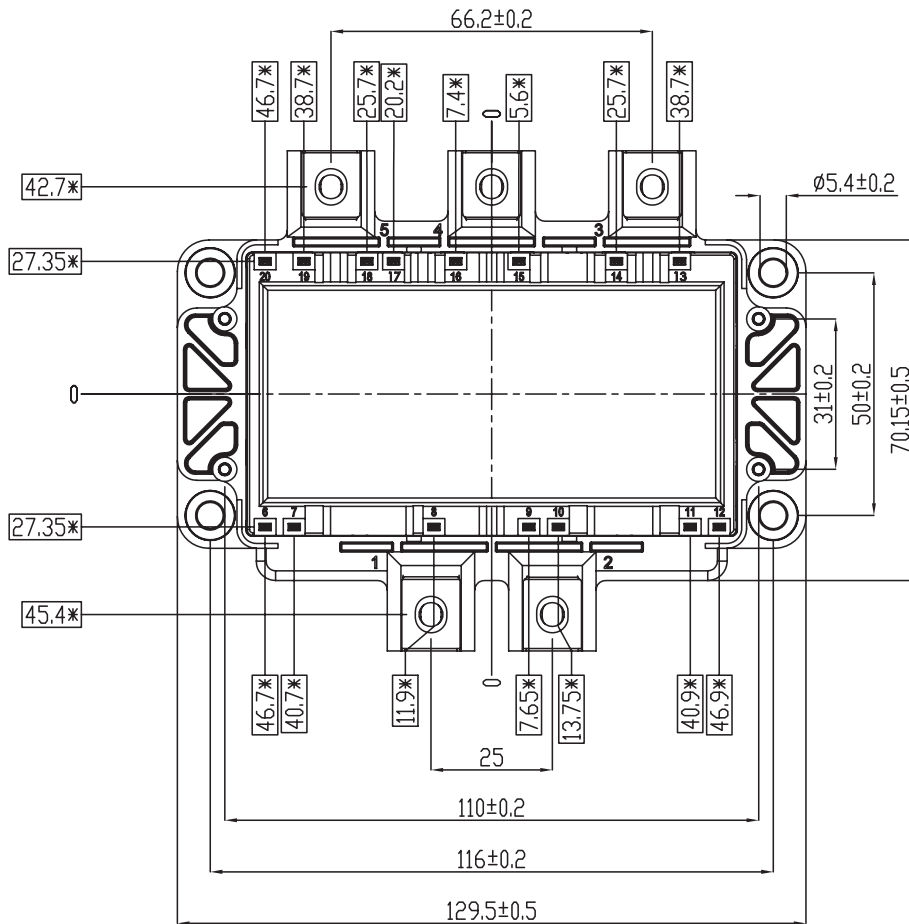
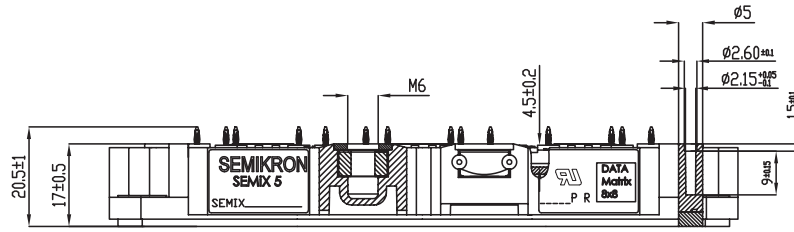
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| Characteristics | | | | | | | |
|---------------------------|--|---------------------------|-------------------|----------------|------|------------|----|
| Symbol | Conditions | | min. | typ. | max. | Unit | |
| Module | | | | | | | |
| L_{sCE1} | | | | 32 | | nH | |
| L_{sCE2} | | | | t.b.d. | | nH | |
| R_{CC+EE} | measured between terminal 5 and 1 | $T_C = 25^\circ\text{C}$ | | 1.2 | | m Ω | |
| | | $T_C = 125^\circ\text{C}$ | | 1.65 | | m Ω | |
| $R_{th(c-s)1}$ | calculated without thermal coupling | | | 0.009 | | K/W | |
| $R_{th(c-s)2}$ | including thermal coupling, T_s underneath module ($\lambda_{grease}=0.81\text{ W/(m}^2\text{K)}$) | | | t.b.d. | | K/W | |
| | including thermal coupling, T_s underneath module, pre-applied phase change material | | | t.b.d. | | K/W | |
| M_s | to heat sink (M5) | | 3 | | 6 | Nm | |
| M_t | | | to terminals (M6) | | 3 | 6 | Nm |
| | | | | | | | Nm |
| W | | | | 398 | | g | |
| Temperature Sensor | | | | | | | |
| R_{100} | $T_C=100^\circ\text{C}$ ($R_{25}=5\text{ k}\Omega$) | | | $493 \pm 5\%$ | | Ω | |
| $B_{100/125}$ | $R(T)=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; $T[K]$; | | | $3550 \pm 2\%$ | | K | |



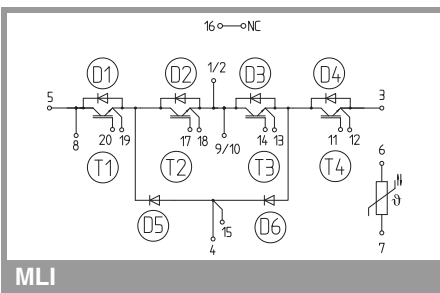
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* = All dimension with tolerance of ± 0.4

For technical details please refer to SEMiX(R)5 Mounting Instruction

SEMiX5p



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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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