**FEATURES**

- 10μs Short Circuit Withstand
- High Thermal Cycling Capability
- High Current Density Enhanced DMOS SPT
- Isolated AlSiC Base With AlN Substrates

**APPLICATIONS**

- High Reliability Inverters
- Motor Controllers
- Traction Drives
- Choppers

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 1200V to 6500V and currents up to 2400A.

The DIM1200ASM45-TL000 is a single switch 4500V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10μs short circuit withstand. This device is optimised for traction drives and other applications requiring high thermal cycling capability.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise grounded heat sinks for safety.

**ORDERING INFORMATION**

Order As:

**DIM1200ASM45-TL000**

Note: When ordering, please use the complete part number

**KEY PARAMETERS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CES}$</td>
<td>4500V</td>
</tr>
<tr>
<td>$V_{CE(sat)}$</td>
<td>2.3V</td>
</tr>
<tr>
<td>$I_C (typ)$</td>
<td>1200A</td>
</tr>
<tr>
<td>$I_{C(PK)} (max)$</td>
<td>2400A</td>
</tr>
</tbody>
</table>

* Measured at the auxiliary terminals

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Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures

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ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under ‘Absolute Maximum Ratings’ may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

\( T_{\text{case}} = 25^\circ\text{C} \) unless stated otherwise

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{\text{CES}} )</td>
<td>Collector-emitter voltage</td>
<td>( V_{\text{GE}} = 0\text{V} )</td>
<td>4500</td>
<td>V</td>
</tr>
<tr>
<td>( V_{\text{GES}} )</td>
<td>Gate-emitter voltage</td>
<td>±20</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>( I_{\text{C}} )</td>
<td>Continuous collector current</td>
<td>( T_{\text{case}} = 95^\circ\text{C} )</td>
<td>1200</td>
<td>A</td>
</tr>
<tr>
<td>( I_{\text{C}(\text{PK})} )</td>
<td>Peak collector current</td>
<td>1ms, ( T_{\text{case}} = 115^\circ\text{C} )</td>
<td>2400</td>
<td>A</td>
</tr>
<tr>
<td>( P_{\text{max}} )</td>
<td>Max. transistor power dissipation</td>
<td>( T_{\text{case}} = 25^\circ\text{C}, T_j = 125^\circ\text{C} )</td>
<td>12.5</td>
<td>kW</td>
</tr>
<tr>
<td>( I^{2}t )</td>
<td>Diode ( I^{2}t ) value</td>
<td>( V_R = 0, t_p = 10\text{ms}, T_j = 125^\circ\text{C} )</td>
<td>460</td>
<td>kA^2s</td>
</tr>
<tr>
<td>( V_{\text{isol}} )</td>
<td>Isolation voltage – per module</td>
<td>Commoned terminals to base plate. AC RMS, 1 min, 50Hz</td>
<td>7.4</td>
<td>kV</td>
</tr>
<tr>
<td>( Q_{PD} )</td>
<td>Partial discharge – per module</td>
<td>IEC1287, ( V_1 = 4800\text{V}, V_2 = 3500\text{V}, 50\text{Hz RMS} )</td>
<td>10</td>
<td>pC</td>
</tr>
</tbody>
</table>

THERMAL AND MECHANICAL RATINGS

Internal insulation material: AlN
Baseplate material: AlSiC
Creepage distance: 56mm
Clearance: 26mm
CTI (Comparative Tracking Index): >600

<table>
<thead>
<tr>
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<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_{\text{th(j-c)}} )</td>
<td>Thermal resistance – transistor</td>
<td>Continuous dissipation - junction to case</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>°C/kW</td>
</tr>
<tr>
<td>( R_{\text{th(j-c)}} )</td>
<td>Thermal resistance – diode</td>
<td>Continuous dissipation - junction to case</td>
<td>-</td>
<td>-</td>
<td>16</td>
<td>°C/kW</td>
</tr>
<tr>
<td>( R_{\text{th(c-h)}} )</td>
<td>Thermal resistance – case to heatsink (per module)</td>
<td>Mounting torque 5Nm (with mounting grease)</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>°C/kW</td>
</tr>
<tr>
<td>( T_j )</td>
<td>Junction temperature</td>
<td>Transistor</td>
<td>-</td>
<td>-</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diode</td>
<td>-</td>
<td>-</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>( T_{\text{stg}} )</td>
<td>Storage temperature range</td>
<td>Mounting – M6</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>Nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical connections – M4</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>Nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical connections – M8</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>Nm</td>
</tr>
</tbody>
</table>
**ELECTRICAL CHARACTERISTICS**

\( T_{\text{case}} = 25^\circ\text{C} \) unless stated otherwise.

<table>
<thead>
<tr>
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<th>Test Conditions</th>
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<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_{\text{CES}} )</td>
<td>Collector cut-off current</td>
<td>( V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}} )</td>
<td>4</td>
<td>mA</td>
<td>90</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{\text{GES}} )</td>
<td>Gate leakage current</td>
<td>( V_{\text{GE}} = \pm 20\text{V}, V_{\text{CE}} = 0\text{V} )</td>
<td>1</td>
<td>( \mu\text{A} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{\text{GE(TH)}} )</td>
<td>Gate threshold voltage</td>
<td>( I_C = 120\text{mA}, V_{\text{GE}} = V_{\text{CE}} )</td>
<td>5.8</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{\text{CE(sat)}} )</td>
<td>Collector-emitter saturation voltage</td>
<td>( V_{\text{GE}} = 15\text{V}, I_C = 1200\text{A} )</td>
<td>2.3</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{\text{GE}} = 15\text{V}, I_C = 1200\text{A}, T_j = 125^\circ\text{C} )</td>
<td>2.9</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_F )</td>
<td>Diode forward current</td>
<td>DC</td>
<td>1200</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_{\text{FM}} )</td>
<td>Diode maximum forward current</td>
<td>( t_p = 1\text{ms} )</td>
<td>2400</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_F )</td>
<td>Diode forward voltage</td>
<td>( I_F = 1200\text{A} )</td>
<td>2.8</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_F = 1200\text{A}, T_j = 125^\circ\text{C} )</td>
<td>3.2</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_{\text{ies}} )</td>
<td>Input capacitance</td>
<td>( V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz} )</td>
<td>150</td>
<td>nF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( Q_\text{g} )</td>
<td>Gate charge</td>
<td>( \pm 15\text{V} ) Including external ( C_{\text{ge}} )</td>
<td>17</td>
<td>( \mu\text{C} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_{\text{res}} )</td>
<td>Reverse transfer capacitance</td>
<td>( V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz} )</td>
<td>12</td>
<td>nF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( L_M )</td>
<td>Module inductance</td>
<td></td>
<td>10</td>
<td>nH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( R_{\text{INT}} )</td>
<td>Internal transistor resistance</td>
<td></td>
<td>90</td>
<td>( \mu\Omega )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( SC_{\text{Data}} )</td>
<td>Short circuit current, ( I_{\text{SC}} )</td>
<td>( T_j = 125^\circ\text{C}, V_{\text{CC}} = 3400\text{V} ) ( t_p \leq 10\mu\text{s}, V_{\text{GE}} \leq 15\text{V} ) ( V_{\text{CE(max)}} = V_{\text{CES}} - L \times \text{d}I/\text{d}t ) IEC 60747-9</td>
<td>4800</td>
<td>A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

* \( L \) is the circuit inductance + \( L_M \)

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## ELECTRICAL CHARACTERISTICS

**T\text{\textsubscript{case}} = 25°C unless stated otherwise**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>t\text{d(off)}</td>
<td>Turn-off delay time</td>
<td>I\textsubscript{C} = 1200A, V\textsubscript{GE} = ±15V, V\textsubscript{CE} = 2800V</td>
<td>3000</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t\text{f}</td>
<td>Fall time</td>
<td></td>
<td>600</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E\text{OFF}</td>
<td>Turn-off energy loss</td>
<td></td>
<td>5100</td>
<td>mJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t\text{d(on)}</td>
<td>Turn-on delay time</td>
<td></td>
<td>900</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t\text{r}</td>
<td>Rise time</td>
<td>C\textsubscript{ge} = 220nF, L\textsubscript{S} ~ 165nH</td>
<td>350</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E\text{ON}</td>
<td>Turn-on energy loss</td>
<td></td>
<td>4800</td>
<td>mJ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q\text{rr}</td>
<td>Diode reverse recovery charge</td>
<td>I\text{F} = 1200A, V\textsubscript{CE} = 2800V</td>
<td>1340</td>
<td>μC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I\text{rr}</td>
<td>Diode reverse recovery current</td>
<td>V\textsubscript{CE} = 2800V, dI\text{F}/dt = 3000A/μs</td>
<td>1030</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E\text{rec}</td>
<td>Diode reverse recovery energy</td>
<td></td>
<td>2220</td>
<td>mJ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**T\text{\textsubscript{case}} = 125°C unless stated otherwise**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>t\text{d(off)}</td>
<td>Turn-off delay time</td>
<td>I\textsubscript{C} = 1200A, V\textsubscript{GE} = ±15V, V\textsubscript{CE} = 2800V</td>
<td>3100</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t\text{f}</td>
<td>Fall time</td>
<td></td>
<td>560</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E\text{OFF}</td>
<td>Turn-off energy loss</td>
<td></td>
<td>5200</td>
<td>mJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t\text{d(on)}</td>
<td>Turn-on delay time</td>
<td></td>
<td>900</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t\text{r}</td>
<td>Rise time</td>
<td>C\textsubscript{ge} = 220nF, L\textsubscript{S} ~ 165nH</td>
<td>360</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E\text{ON}</td>
<td>Turn-on energy loss</td>
<td></td>
<td>6450</td>
<td>mJ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q\text{rr}</td>
<td>Diode reverse recovery charge</td>
<td>I\text{F} = 1200A, V\textsubscript{CE} = 2800V</td>
<td>2200</td>
<td>μC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I\text{rr}</td>
<td>Diode reverse recovery current</td>
<td>V\textsubscript{CE} = 2800V, dI\text{F}/dt = 3000A/μs</td>
<td>1100</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E\text{rec}</td>
<td>Diode reverse recovery energy</td>
<td></td>
<td>3750</td>
<td>mJ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

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Fig. 7  Diode typical forward characteristics

Fig. 8  Reverse bias safe operating area

Fig. 9  Diode reverse bias safe operating area

Fig. 10  Transient thermal impedance

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The products are not intended for use in applications where a failure or malfunction may cause loss of life, injury or damage to property. The user must ensure that appropriate safety precautions are taken to prevent or mitigate the consequences of a product failure or malfunction.

The products must not be touched when operating because there is a danger of electrocution or severe burning. Always use protective safety equipment such as appropriate shields for the product and wear safety glasses. Even when disconnected any electric charge remaining in the product must be discharged and allowed to cool before safe handling using protective gloves.

Extended exposure to conditions outside the product ratings may affect reliability leading to premature product failure. Use outside the product ratings is likely to cause permanent damage to the product. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture, a large current to flow or high voltage arcing, resulting in fire or explosion. Appropriate application design and safety precautions should always be followed to protect persons and property.

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- **Target Information**: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.
- **Preliminary Information**: The product design is complete and final characterisation for volume production is in progress. The datasheet represents the product as it is now understood but details may change.
- **No Annotation**: The product has been approved for production and unless otherwise notified by Dynex any product ordered will be supplied to the current version of the data sheet prevailing at the time of our order acknowledgement.

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**DYNEX SEMICONDUCTOR LTD**
Doddington Road, Lincoln, Lincolnshire, LN6 3LF,
United Kingdom
Fax: +44(0)1522 500550
Tel: +44(0)1522 500500
Web: [http://www.dynexsemi.com](http://www.dynexsemi.com)

CUSTOMER SERVICE

**DYNEX SEMICONDUCTOR LTD**
Doddington Road, Lincoln, Lincolnshire, LN6 3LF,
United Kingdom
Fax: +44(0)1522 500020
Tel: +44(0)1522 502753 / 502901
Email: Power_solutions@dynexsemi.com


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