INSULATED GATE BIPOLAR TRANSISTOR

IRGP4066PbF
IRGP4066-EPbF

Features
- Low $V_{CE(ON)}$ Trench IGBT Technology
- Low Switching Losses
- Maximum Junction Temperature 175 °C
- 5 μS short circuit SOA
- Square RBSOA
- 100% of The Parts Tested for $I_{LM}$
- Positive $V_{CE(ON)}$ Temperature Coefficient
- Tight Parameter Distribution
- Lead Free Package

Benefits
- High Efficiency in a Wide Range of Applications
- Suitable for a Wide Range of Switching Frequencies due to Low $V_{CE(ON)}$ and Low Switching Losses
- Rugged Transient Performance for Increased Reliability
- Excellent Current Sharing in Parallel Operation

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CES}$ Collector-to-Emitter Voltage</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$ @ $T_C$ = 25°C Continuous Collector Current</td>
<td>140</td>
<td>A</td>
</tr>
<tr>
<td>$I_C$ @ $T_C$ = 100°C Continuous Collector Current</td>
<td>90</td>
<td>A</td>
</tr>
<tr>
<td>$I_{NOMINAL}$ Nominal Current</td>
<td>75</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM}$ Pulse Collector Current, $V_{GE}$ = 15V</td>
<td>225</td>
<td>A</td>
</tr>
<tr>
<td>$I_{LM}$ Clamped Inductive Load Current, $V_{GE}$ = 20V</td>
<td>300</td>
<td>A</td>
</tr>
<tr>
<td>$V_{GE}$ Continuous Gate-to-Emitter Voltage</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>$P_{D}$ @ $T_C$ = 25°C Maximum Power Dissipation</td>
<td>454</td>
<td>W</td>
</tr>
<tr>
<td>$P_{D}$ @ $T_C$ = 100°C Maximum Power Dissipation</td>
<td>227</td>
<td>W</td>
</tr>
<tr>
<td>$T_J$ Operating Junction and Storage Temperature Range</td>
<td>-55 to +175</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{STG}$ Soldering Temperature, for 10 sec.</td>
<td>300 (0.063 in. (1.6mm) from case)</td>
<td>°C</td>
</tr>
<tr>
<td>Mounting Torque, 6-32 or M3 Screw</td>
<td>10 lbf-in (1.1 N-m)</td>
<td></td>
</tr>
</tbody>
</table>

Thermal Resistance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{JUC}$ Thermal Resistance Junction-to-Case ©</td>
<td></td>
<td></td>
<td>0.33</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{JCS}$ Thermal Resistance, Case-to-Sink (flat, greased surface)</td>
<td></td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{JUA}$ Thermal Resistance, Junction-to-Ambient (typical socket mount)</td>
<td></td>
<td></td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
### Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{BR(CES)}</td>
<td>600</td>
<td>—</td>
<td>—</td>
<td>V</td>
<td>V_{CC} = 0V, I_C = 100µA</td>
</tr>
<tr>
<td>ΔV_{BR(CES)}/ΔT_J</td>
<td>—</td>
<td>260</td>
<td>—</td>
<td>mV/°C</td>
<td>V_{CC} = 0V, I_C = 2.0mA (25°C-175°C)</td>
</tr>
<tr>
<td>V_{CE(on)}</td>
<td>1.7</td>
<td>2.1</td>
<td>—</td>
<td>V</td>
<td>I_C = 75A, V_{GE} = 15V, T_J = 25°C</td>
</tr>
<tr>
<td>V_{GE(th)}</td>
<td>4.0</td>
<td>—</td>
<td>6.5</td>
<td>V</td>
<td>V_{CC} = 50V, IC = 75A, PW = 60μs</td>
</tr>
<tr>
<td>ΔV_{GE(th)}/ΔT_J</td>
<td>—</td>
<td>-16</td>
<td>—</td>
<td>mV/°C</td>
<td>V_{CC} = V_{GE}, I_C = 2.1mA (25°C - 175°C)</td>
</tr>
<tr>
<td>g_{FE}</td>
<td>50</td>
<td>—</td>
<td>—</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>I_{CES}</td>
<td>1040</td>
<td>—</td>
<td>—</td>
<td>µA</td>
<td>V_{CC} = 0V, V_{CE} = 600V</td>
</tr>
<tr>
<td>I_{VES}</td>
<td>—</td>
<td>—</td>
<td>±200</td>
<td>nA</td>
<td>V_{GE} = ±20V</td>
</tr>
</tbody>
</table>

### Switching Characteristics @ T_J = 25°C (unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q_g</td>
<td>150</td>
<td>—</td>
<td>225</td>
<td>nC</td>
<td>I_C = 75A</td>
</tr>
<tr>
<td>Q_{ge}</td>
<td>40</td>
<td>—</td>
<td>60</td>
<td>nC</td>
<td>V_{GE} = 15V</td>
</tr>
<tr>
<td>Q_{GC}</td>
<td>60</td>
<td>—</td>
<td>90</td>
<td>nC</td>
<td>V_{CC} = 400V</td>
</tr>
<tr>
<td>E_{on}</td>
<td>2465</td>
<td>—</td>
<td>3360</td>
<td>µJ</td>
<td></td>
</tr>
<tr>
<td>E_{off}</td>
<td>2155</td>
<td>—</td>
<td>3040</td>
<td>µJ</td>
<td></td>
</tr>
<tr>
<td>E_{total}</td>
<td>4620</td>
<td>—</td>
<td>6400</td>
<td>Energy losses include tail &amp; diode reverse recovery</td>
<td></td>
</tr>
<tr>
<td>I_{on}</td>
<td>50</td>
<td>—</td>
<td>70</td>
<td>ns</td>
<td>I_C = 75A, V_{CC} = 400V, V_{GE} = 15V</td>
</tr>
<tr>
<td>t_{r}</td>
<td>70</td>
<td>—</td>
<td>90</td>
<td>ns</td>
<td>R_D = 10Ω, L = 200µH, T_J = 25°C</td>
</tr>
<tr>
<td>t_{off}</td>
<td>200</td>
<td>—</td>
<td>225</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>t_{f}</td>
<td>60</td>
<td>—</td>
<td>80</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>E_{on}</td>
<td>3870</td>
<td>—</td>
<td>—</td>
<td>µJ</td>
<td>I_C = 75A, V_{CC} = 400V, V_{GE} = 15V</td>
</tr>
<tr>
<td>E_{off}</td>
<td>2815</td>
<td>—</td>
<td>—</td>
<td>µJ</td>
<td>R_D=10Ω, L=200µH,T_J = 25°C</td>
</tr>
<tr>
<td>E_{total}</td>
<td>6685</td>
<td>—</td>
<td>—</td>
<td>Energy losses include tail &amp; diode reverse recovery</td>
<td></td>
</tr>
<tr>
<td>I_{on}</td>
<td>50</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td>I_C = 75A, V_{CC} = 400V, V_{GE} = 15V</td>
</tr>
<tr>
<td>t_{r}</td>
<td>70</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td>R_D = 10Ω, L = 200µH</td>
</tr>
<tr>
<td>t_{off}</td>
<td>240</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td>T_J = 175°C</td>
</tr>
<tr>
<td>t_{f}</td>
<td>70</td>
<td>—</td>
<td>—</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>C_{ins}</td>
<td>4440</td>
<td>—</td>
<td>—</td>
<td>pF</td>
<td>V_{CC} = 0V</td>
</tr>
<tr>
<td>C_{oss}</td>
<td>245</td>
<td>—</td>
<td>—</td>
<td>pF</td>
<td>V_{CC} = 30V</td>
</tr>
<tr>
<td>C_{rss}</td>
<td>130</td>
<td>—</td>
<td>—</td>
<td>f = 1.0MHz</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. V_{CC} = 80% (V_{CES}). V_{GE} = 20V, L = 10µH, R_G = 10Ω.
2. Pulse width limited by max. junction temperature.
3. Refer to AN-1086 for guidelines for measuring V_{BR(CES)} safely.
4. R_G is measured at T_J of approximately 90°C.
Fig. 1 - Maximum DC Collector Current vs. Case Temperature

Fig. 2 - Power Dissipation vs. Case Temperature

Fig. 3 - Forward SOA
T_C = 25°C, T_J ≤ 175°C; V_{GE} = 15V

Fig. 4 - Reverse Bias SOA
T_J = 175°C; V_{GE} = 20V

Fig. 5 - Typ. IGBT Output Characteristics
T_J = -40°C; \( t_p \leq 60 \mu s \)

Fig. 6 - Typ. IGBT Output Characteristics
T_J = 25°C; \( t_p \leq 60 \mu s \)
Fig. 7 - Typ. IGBT Output Characteristics
\( T_J = 175^\circ C; \ t_p \leq 60\mu s \)

Fig. 8 - Typical \( V_{CE} \) vs. \( V_{GE} \)
\( T_J = -40^\circ C \)

Fig. 9 - Typical \( V_{CE} \) vs. \( V_{GE} \)
\( T_J = 25^\circ C \)

Fig. 10 - Typical \( V_{CE} \) vs. \( V_{GE} \)
\( T_J = 175^\circ C \)

Fig. 11 - Typ. Transfer Characteristics
\( V_{CE} = 50V; \ t_p = 60\mu s \)

Fig. 12 - Typ. Energy Loss vs. \( I_C \)
\( T_J = 175^\circ C; \ L = 200\mu H; \ V_{CE} = 400V; \ R_G = 10\Omega; \ V_{GE} = 15V \)
Fig. 13 - Typ. Switching Time vs. $I_C$
$T_J = 175^\circ C; \ L = 200\mu H; \ V_{CE} = 400V, \ R_G = 10\Omega; \ V_{GE} = 15V$

Fig. 14 - Typ. Energy Loss vs. $R_G$
$T_J = 175^\circ C; \ L = 200\mu H; \ V_{CE} = 400V, \ I_{CE} = 75A; \ V_{GE} = 15V$

Fig. 15 - Typ. Switching Time vs. $R_G$
$T_J = 175^\circ C; \ L = 200\mu H; \ V_{CE} = 400V, \ I_{CE} = 75A; \ V_{GE} = 15V$

Fig. 16 - $V_{GE}$ vs. Short Circuit Time
$V_{CC} = 400V; \ T_C = 25^\circ C$

Fig. 17 - Typ. Capacitance vs. $V_{CE}$
$V_{GE} = 0V; \ f = 1MHz$
**Fig. 18** - Typical Gate Charge vs. $V_{GE}$

$I_{CE} = 75A; L = 485\mu H$

**Fig. 19.** Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)
Fig.C.T.1 - Gate Charge Circuit (turn-off)

Fig.C.T.2 - RBSOA Circuit

Fig.C.T.3 - S.C. SOA Circuit

Fig.C.T.4 - Switching Loss Circuit

Fig.C.T.5 - Resistive Load Circuit

Fig.C.T.6 - BVCES Filter Circuit
Fig. WF1 - Typ. Turn-off Loss Waveform
@ $T_J = 175^\circ C$ using Fig. CT.4

Fig. WF2 - Typ. Turn-on Loss Waveform
@ $T_J = 175^\circ C$ using Fig. CT.4

Fig. WF3 - Typ. S.C. Waveform
@ $T_J = 25^\circ C$ using Fig. CT.3
IRGP4066PbF/IRGP4066-EPbF

TO-247AC Package Outline

Dimensions are shown in millimeters (inches).

TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30 WITH ASSEMBLY LOT CODE 5657 ASSEMBLED ON WW 35, 2001 IN THE ASSEMBLY LINE 'H'.

Note: 'P' in assembly line position indicates 'Lead-Free'.

TO-247AC package is not recommended for Surface Mount Application.

Note: For the most current drawing please refer to IR website at http://www.irf.com/package/
IRGP4066PbF/IRGP4066-EPbF

TO-247AD Package Outline
Dimensions are shown in millimeters (inches)

TO-247AD Part Marking Information

EXAMPLE: THIS IS AN IRGP30B120KD-E WITH ASSEMBLY LOT CODE 5657 ASSEMBLED ON WW 35, 2000 IN THE ASSEMBLY LINE "H"

Note: "P" in assembly line position indicates "Lead-Free"

TO-247AD package is not recommended for Surface Mount Application.

Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial market.
Qualification Standards can be found on IR’s Web site.