The Next Generation High Speed IGBT Family From Infineon

PCIM Europe
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IGBT Product Marketing
Infineon Power Discretes
Infineon ... the Leader in Power Semiconductors in 2008 *

- Market leader in Power Semiconductors since 2003!
- Technology leadership leading to ...
- ...innovative product portfolio for efficiency improvements and system miniaturization

### Global Power Semiconductor Market Ranking: Market Size in 2008 USD 14.0 bn

<table>
<thead>
<tr>
<th>Rank 2008</th>
<th>Supplier</th>
<th>2007</th>
<th>2008</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Infineon</td>
<td>9.6%</td>
<td>10.2%</td>
<td>0.6%-pt</td>
</tr>
<tr>
<td>2</td>
<td>Vishay</td>
<td>6.7%</td>
<td>6.8%</td>
<td>0.1%-pt</td>
</tr>
<tr>
<td>3</td>
<td>STMicroelectronics</td>
<td>7.3%</td>
<td>6.6%</td>
<td>-0.7%-pt</td>
</tr>
<tr>
<td>4</td>
<td>Fairchild</td>
<td>6.9%</td>
<td>6.5%</td>
<td>-0.4%-pt</td>
</tr>
<tr>
<td>5</td>
<td>Mitsubishi (inc. Powerex)</td>
<td>5.5%</td>
<td>6.4%</td>
<td>0.9%-pt</td>
</tr>
</tbody>
</table>

*Source: IMS Research, Global Market for Power Semiconductor Discretes & Modules, July 2009*
Infineon is the #1 world wide supplier of discrete IGBTs ... 
... where 1 in every 4 discrete IGBT sold comes from Infineon*

*IMS-The World Market for Power Semiconductor Discretes & Modules 2009

How is this possible?

✓ High efficiency (cooler packages)
✓ Low switching & conduction losses
✓ Excellent EMI behaviour
✓ Highest quality standards
✓ Logistic Management
New 3rd Generation Family for Switching Frequencies up to 100kHz

 ✓ Target applications:
   ✓ Welding / Solar / UPS
   ✓ PFC / SMPS
   ✓ Lamp ballast
   ✓ All high frequency – hard switching applications

 ✓ Lowest total losses at high speed operation
 ✓ Proven cosmic radiation robustness
 ✓ Low gate resistor selection possible (down to $5\Omega$) whilst maintaining excellent switching behaviour
 ✓ Excellent EMI performance
IGBT Performance Tuning for High Speed

There is trade-off - but we haven’t given up!

Reduced carrier concentration:
- Lower Eoff
- Higher VCEsat

The perfect switch

Conduction losses (VCEsat)

Switching losses (Eoff)
High Speed IGBT Competitor Landscape

Trade-off diagram

\[ I_c = \frac{I_n}{2},\ T_j = 150^\circ C \]

VCEsat / V

Eoff / μJ/A

IKP15N60T
SKB15N60HS
Competitor A
IGW40N60H3
HighSpeed3
Competitor B

HighSpeed3 family optimised for high switching frequencies
Application test – PFC at 100kHz

HighSpeed3 IGBT provides ~ 1% better efficiency than conventional MOSFETs at 100 kHz!!
**PFC Application Test at 100kHz**

**Guess Which Waveform is that of an IGBT?**

**EMI – What EMI?**

- Smooth switching waveforms in application
- No Current oscillations
- No overvoltage

**Gate resistor selection**

- Go low for high performance

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**Turn-off: H3 vs std IGBT3**

\[ R_g = 11 \text{ Ohm}, V_{ce} = 400 \text{V}, T_J = 150^\circ \text{C} \]

- \( I_c = 30 \text{A} \)
- \( V_{ce} = 400 \text{V} \)
- \( V_{cesat} = 2.0 \text{V} \)
- \( E_{off} = 0.34 \text{mJ} \)
- \( V_{cesat} = 1.6 \text{V} \)
- \( E_{off} = 0.85 \text{mJ} \)

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**Vce=100 V / div**

**Vge=5 V / div**

**Ic=1 A / div**
**Infineon’s High Speed 3 IGBT Portfolio**

**600V and 1200V Product Family**

<table>
<thead>
<tr>
<th>Single IGBT</th>
<th>600V</th>
<th>1200V</th>
</tr>
</thead>
<tbody>
<tr>
<td>15A</td>
<td></td>
<td>IGP15N120H3</td>
</tr>
<tr>
<td>20A</td>
<td>IGP20N60H3</td>
<td>IGP25N120H3</td>
</tr>
<tr>
<td>25A</td>
<td>IGP30N60H3</td>
<td>IGP40N120H3</td>
</tr>
<tr>
<td>30A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40A</td>
<td>IGW40N60H3</td>
<td></td>
</tr>
<tr>
<td>50A</td>
<td>IGW50N60H3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>DuoPack™</th>
<th>600V</th>
<th>1200V</th>
</tr>
</thead>
<tbody>
<tr>
<td>15A</td>
<td></td>
<td>IKW15N120H3</td>
</tr>
<tr>
<td>20A</td>
<td></td>
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</tr>
<tr>
<td>25A</td>
<td></td>
<td>IKW25N120H3</td>
</tr>
<tr>
<td>30A</td>
<td>IKW30N60H3</td>
<td>IKW40N120H3</td>
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Continuous collector current at \( T_C = 100^\circ C \)

All devices are fully released
Summary

Infineon’s new 600V and 1200V High Speed3 IGBT family has been developed for operation up to 100kHz

Offering

~1% efficiency improvement over all load conditions compared to conventional planar MOSFETS

Best class IGBT in PFC stage

EMI and RF filtering requirements significantly reduced

Temperature stable behaviour

Smaller die sizes → smaller packages

Excellent price / performance behaviour
Thank you for your attention

Mark Thomas

Discrete IGBT Product Marketing

Please visit us at Hall 12 – Booth 404

www.infineon.com/igbt
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SECURITY

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