

AIKW20N60CT-VB Datasheet

600V Trench and Fieldstop IGBT

| PRODUCT SUMMARY | | |
|---------------------------|----------------------------|-----------------------------|
| V _{CE} (V) | 600 | |
| I _C (A) | 40 (T _C =25 °C) | 20 (T _C =100 °C) |
| V _{CE (sat)} (V) | 1.6 | |
| I _{CM} (A) | 60 | |

FEATURES

- Very Low V_{CEsat}
- Low turn-off losses
- High speed switching
- Maximum junction temperature 175°C
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)



RoHS
COMPLIANT
HALOGEN
FREE

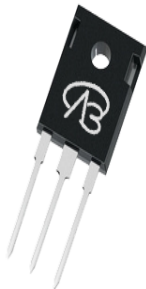
APPLICATIONS

- Telecommunications
 - Server and telecom power supplies
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Consumer and computing
 - ATX power supplies
- Industrial
 - Welding
 - Battery chargers
- Renewable energy
 - Solar (PV inverters)
- Switch mode power supplies (SMPS)

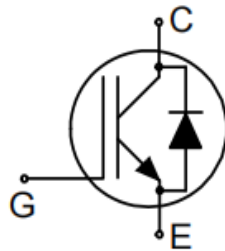
Package pin definition

- Pin1 G - Gate
- Pin2 C & backside - Collector
- Pin3 E - Emitter

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Top View



| ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted) | | | |
|---|-----------------------------------|---|------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Collector-Emitter Voltage | V _{CE} | 600 | V |
| Gate-Emitter Voltage | V _{GE} | ±30 | |
| Continuous Collector Current (T _J = 150 °C) | V _{GE} at 15 V | T _C = 25 °C | A |
| | | T _C = 100 °C | |
| Pulsed Collector Current ^a | I _{CM} | 60 | |
| Diode Forward Current ^b | I _F | 20 | A |
| Maximum Power Dissipation | P _D | T _C = 25 °C | 266 |
| | | T _C = 100 °C | 158 |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | -55 to +175 | °C |
| Short Circuit Withstand Time ^{TC=150} | t _{sc} | V _{GE} = 15V, V _{CE} 400V | 3 |
| Short Circuit Withstand Time ^{TC=100} | | V _{GE} = 15V, V _{CE} 330V | 5 |
| Soldering Recommendations (Peak Temperature) ^c | | for 10 s | 260 |
| | | | °C |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Current limited by maximum junction temperature.
- 1.6 mm from case.

| THERMAL RESISTANCE RATINGS | | | | |
|-----------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 40 | °C/W |
| Maximum Junction-to-Case | R_{thJC} | - | 0.5 | |

| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | | |
|---|---------------|--|--|------------|--------|--------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Collector-Emitter Breakdown Voltage | BV_{CE} | $V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$ $V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$ | | 600 600 | - - | - - | V |
| Gate-Source Threshold Voltage (N) | $V_{GE(th)}$ | $V_{CE} = V_{GE}, I_D = 250\text{ }\mu\text{A}$ | | 4 | 5 | 6 | V |
| Zero Gate Voltage Collector Current | I_{CES} | $V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 25\text{ }^\circ\text{C}$ | | - | 1 | 20 | μA |
| | | $V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$ | | - | 1000 | - | μA |
| Gate-Emitter Leakage Current | I_{GES} | $V_{CE} = 0\text{ V}, V_{GS} = \pm 2.0\text{ V}$ | | - | - | 100 | nA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE} = 15\text{ V}$ | $I_C = 20\text{ A}$ | - | 1.8 | 2.1 | V |
| Forward Transconductance | g_{fs} | $V_{CE} = 20\text{ V}, I_C = 20\text{ A}$ | | - | 17 | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{ies} | $V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V},$ $f = 500\text{ KHz}$ | | - | 2200 | - | pF |
| Output Capacitance | C_{oes} | | | - | 162 | - | |
| Reverse Transfer Capacitance | C_{res} | | | - | 121 | - | |
| Turn-on Energy | E_{on} | $V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 20\text{ A}, R_g = 10\Omega$ | | - | 17 | - | nJ |
| Turn-off Energy | E_{off} | | | - | 0.5 | - | |
| Total Gate Charge | Q_g | $V_{GE} = 20\text{ V}$ | $I_C = 20\text{ A}, V_{CE} = 400\text{ V}$ | - | 218 | - | nC |
| Gate-Emitter Charge | Q_{ge} | | | - | 62 | - | |
| Gate to Collector Charge | Q_{gc} | | | - | 121 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 20\text{ A}, R_g = 10\Omega$ | | - | 46 | - | ns |
| Rise Time | t_r | | | - | 42 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 165 | - | |
| Fall Time | t_f | | | - | 31 | - | |
| Internal emitter inductance measured 5 mm | L_E | | | - | 13 | - | |
| Diode Characteristics | | | | | | | |
| Diode Forward Current | I_F | IGBT symbol showing the integral reverse junction diode | | - | - | 20 | A |
| Pulsed Diode Forward Current | I_{FM} | | | - | - | 60 | |
| Diode Forward Voltage | V_F | $I_F = 20\text{ A}$ | | - | 1.51 | 2.0 | V |
| Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = 20\text{ A},$ $dI_F/dt = 200\text{ A}/\mu\text{s}, V_R = 400\text{ V}$ | | - | 45 | - | ns |
| Reverse Recovery Charge | Q_{rr} | | | - | 0.23 | - | μC |
| Reverse Recovery Current | I_{RRM} | | | - | 11.6 | - | A |



Figure 1. **Forward bias safe operating area**
($D=0$, $T_C=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$.
Recommended use at $V_{GE}\geq 7.5\text{V}$)



Figure 2. **Power dissipation as a function of case temperature**
($T_{vj}\leq 175^\circ\text{C}$)



Figure 3. **Collector current as a function of case temperature**



Figure 4. **Typical output characteristic**



Figure 5. Typical output characteristic ($T_{vj}=150^{\circ}\text{C}$)



Figure 6. Typical transfer characteristic ($V_{CE}=20\text{V}$)



Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature



Figure 8. Typical switching times as a function of collector current

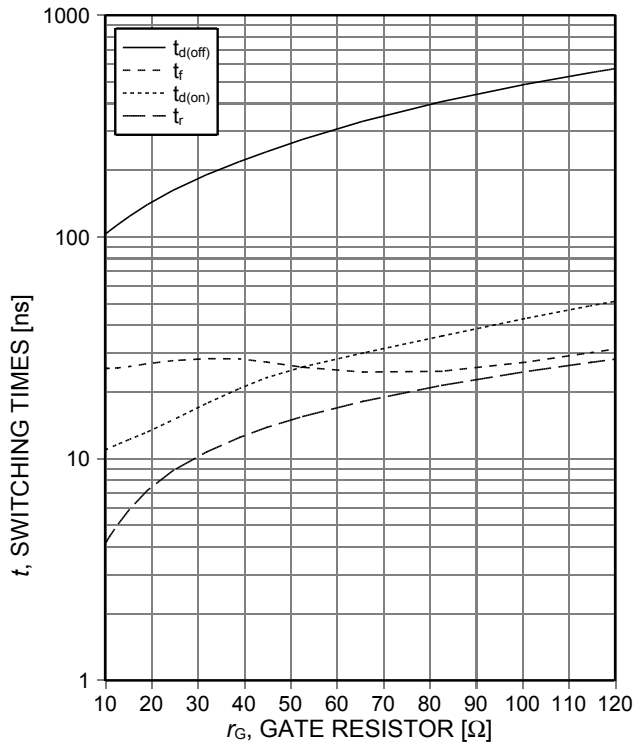


Figure 9. Typical switching times as a function of gate resistor



Figure 10. Typical switching times as a function of junction temperature

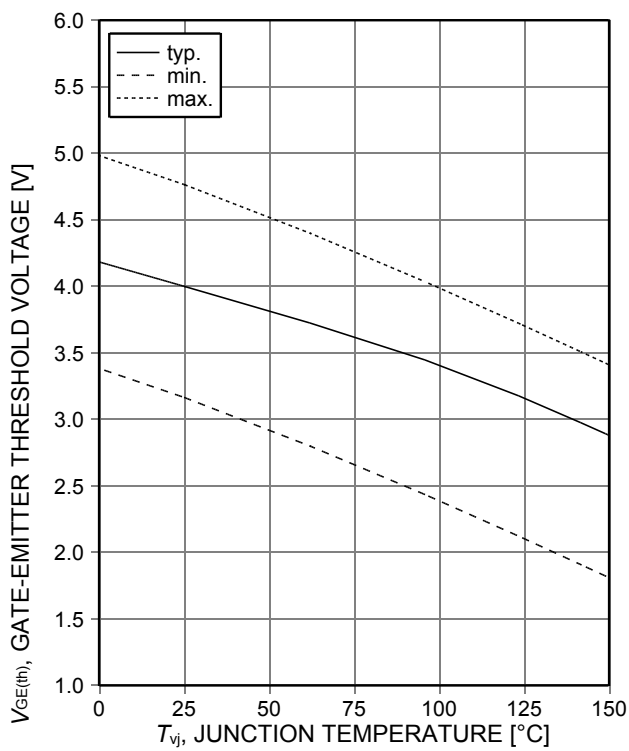


Figure 11. Gate-emitter threshold voltage as a function of junction temperature

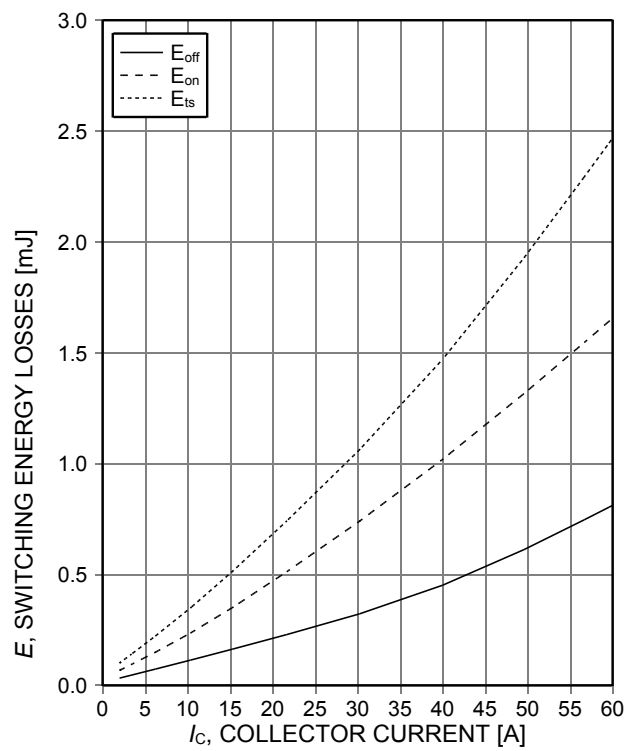


Figure 12. Typical switching energy losses as a function of collector current



Figure 13. Typical switching energy losses as a function of gate resistor



Figure 14. Typical switching energy losses as a function of junction temperature



Figure 15. Typical switching energy losses as a function of collector emitter voltage



Figure 16. Typical gate charge



Figure 17. Typical capacitance as a function of collector-emitter voltage

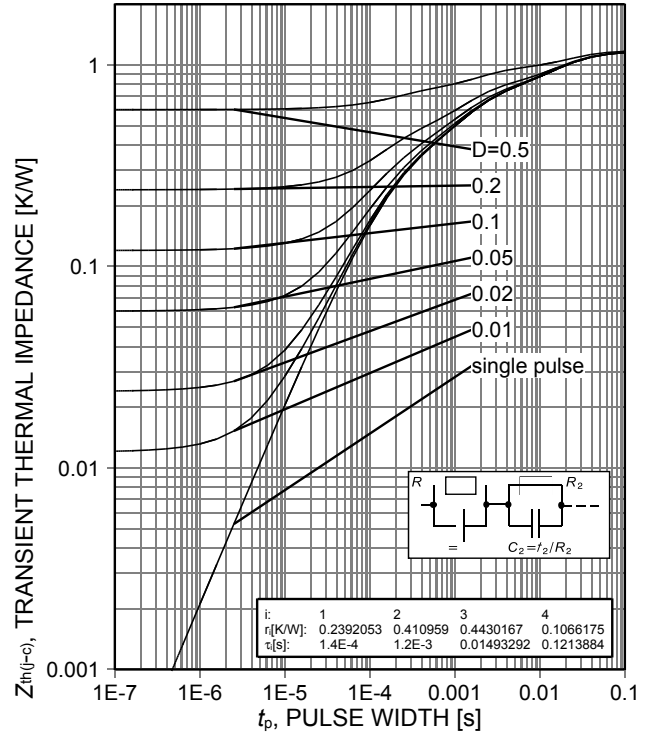


Figure 18. IGBT transient thermal impedance



Figure 19. Diode transient thermal impedance as a function of pulse width



Figure 20. Typical reverse recovery time as a function of diode current slope

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| DIM. | MILLIMETERS | | INCHES | |
|-----------------|-------------|-------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.70 | 5.31 | 0.185 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b2 | 1.65 | 2.41 | 0.065 | 0.095 |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 |
| c | 0.61 BSC | | 0.024 BSC | |
| D | 20.80 | 21.46 | 0.819 | 0.845 |
| D1 | 3.68 | 5.49 | 0.145 | 0.216 |
| (e) | 5.46 BSC | | 0.215 BSC | |
| E | 15.49 | 16.26 | 0.610 | 0.640 |
| L | 19.81 | 20.32 | 0.780 | 0.800 |
| L1 | 4.06 | 4.50 | 0.160 | 0.177 |
| $\varnothing p$ | 3.51 | 3.66 | 0.138 | 0.144 |

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