

# High Voltage IGBT with Diode

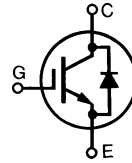
Combi Pack  
Short Circuit SOA Capability

**IXSK35N120AU1**

$$V_{CES} = 1200 \text{ V}$$

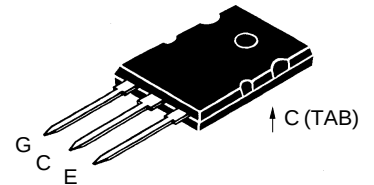
$$I_{C25} = 70 \text{ A}$$

$$V_{CE(sat)} = 4 \text{ V}$$



| Symbol                             | Test Conditions                                                                                                   | Maximum Ratings                  |                      |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------|
| $V_{CES}$                          | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                                                                    | 1200                             | V                    |
| $V_{CGR}$                          | $T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$                                        | 1200                             | V                    |
| $V_{GES}$                          | Continuous                                                                                                        | $\pm 20$                         | V                    |
| $V_{GEM}$                          | Transient                                                                                                         | $\pm 30$                         | V                    |
| $I_{C25}$                          | $T_C = 25^\circ\text{C}$                                                                                          | 70                               | A                    |
| $I_{C90}$                          | $T_C = 90^\circ\text{C}$                                                                                          | 35                               | A                    |
| $I_{CM}$                           | $T_C = 25^\circ\text{C}, 1 \text{ ms}$                                                                            | 140                              | A                    |
| <b>SSOA (RBSOA)</b>                | $V_{GE} = 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 22 \Omega$<br>Clamped inductive load, $L = 30 \mu\text{H}$ | $I_{CM} = 70$<br>@ $0.8 V_{CES}$ | A                    |
| <b><math>t_{SC}</math> (SCSOA)</b> | $V_{GE} = 15 \text{ V}, V_{CE} = 720 \text{ V}, T_J = 125^\circ\text{C}$<br>$R_G = 22 \Omega$ , non repetitive    | 10                               | $\mu\text{s}$        |
| $P_C$                              | $T_C = 25^\circ\text{C}$                                                                                          | IGBT<br>Diode                    | 300<br>190<br>W<br>W |
| $T_J$                              |                                                                                                                   | -55 ... +150                     | $^\circ\text{C}$     |
| $T_{JM}$                           |                                                                                                                   | 150                              | $^\circ\text{C}$     |
| $T_{stg}$                          |                                                                                                                   | -55 ... +150                     | $^\circ\text{C}$     |
| $T_L$                              | 1.6 mm (0.063 in) from case for 10 s                                                                              | 300                              | $^\circ\text{C}$     |
| $M_d$                              | Mounting torque                                                                                                   | 1.15/13                          | Nm/lb.in.            |
| <b>Weight</b>                      |                                                                                                                   | 10                               | g                    |

TO-264 AA



G = Gate, C = Collector,  
E = Emitter, TAB = Collector

## Features

- International standard package JEDEC TO-264 AA
- High frequency IGBT and anti-parallel FRED in one package
- 2nd generation HDMOS™ process
- Low  $V_{CE(sat)}$ 
  - for minimum on-state conduction losses
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
  - soft recovery with low  $I_{RM}$

## Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

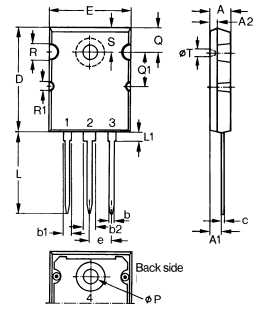
## Advantages

- Space savings (two devices in one package)
- Easy to mount with one screw (isolated mounting screw hole)
- High power density

| Symbol        | Test Conditions                                        | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                            |
|---------------|--------------------------------------------------------|-----------------------------------------------------------------------------------|------|----------------------------|
|               |                                                        | min.                                                                              | typ. | max.                       |
| $BV_{CES}$    | $I_C = 5 \text{ mA}, V_{GE} = 0 \text{ V}$             | 1200                                                                              |      | V                          |
| $V_{GE(th)}$  | $I_C = 4 \text{ mA}, V_{CE} = V_{GE}$                  | 4                                                                                 |      | V                          |
| $I_{CES}$     | $V_{CE} = 0.8 \cdot V_{CES}$<br>$V_{GE} = 0 \text{ V}$ |                                                                                   |      | 750 $\mu\text{A}$<br>15 mA |
| $I_{GES}$     | $V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$      |                                                                                   |      | $\pm 100 \text{ nA}$       |
| $V_{CE(sat)}$ | $I_C = I_{C90}, V_{GE} = 15 \text{ V}$                 |                                                                                   |      | 4 V                        |

| Symbol       | Test Conditions                                                                                                                                                                              | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |          |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|----------|
|              |                                                                                                                                                                                              | min.                                                                              | typ. | max.     |
| $g_{fs}$     | $I_C = I_{C90}$ ; $V_{CE} = 10\text{ V}$ ,<br>Pulse test, $t \leq 300\text{ }\mu\text{s}$ , duty cycle $\leq 2\%$                                                                            | 20                                                                                | 26   | S        |
| $I_{C(on)}$  | $V_{GE} = 15\text{ V}$ , $V_{CE} = 10\text{ V}$                                                                                                                                              |                                                                                   | 170  | A        |
| $C_{ies}$    | $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$                                                                                                                          |                                                                                   | 3900 | pF       |
| $C_{oes}$    |                                                                                                                                                                                              |                                                                                   | 295  | pF       |
| $C_{res}$    |                                                                                                                                                                                              |                                                                                   | 60   | pF       |
| $Q_g$        | $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5\text{ V}_{CES}$                                                                                                                     |                                                                                   | 150  | nC       |
| $Q_{ge}$     |                                                                                                                                                                                              |                                                                                   | 40   | nC       |
| $Q_{gc}$     |                                                                                                                                                                                              |                                                                                   | 70   | nC       |
| $t_{d(on)}$  | Inductive load, $T_J = 25^\circ\text{C}$<br><br>$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ ,<br>$L = 100\text{ }\mu\text{H}$ , $V_{CE} = 0.8\text{ V}_{CES}$ , $R_G = 2.7\text{ }\Omega$       |                                                                                   | 80   | ns       |
| $t_{ri}$     |                                                                                                                                                                                              |                                                                                   | 150  | ns       |
| $t_{d(off)}$ |                                                                                                                                                                                              |                                                                                   | 400  | ns       |
| $t_{fi}$     |                                                                                                                                                                                              |                                                                                   | 500  | ns       |
| $E_{off}$    |                                                                                                                                                                                              | Note 1                                                                            | 10   | mJ       |
| $t_{d(on)}$  | Inductive load, $T_J = 125^\circ\text{C}$<br><br>$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ ,<br>$L = 100\text{ }\mu\text{H}$<br><br>$V_{CE} = 0.8\text{ V}_{CES}$ , $R_G = 2.7\text{ }\Omega$ |                                                                                   | 80   | ns       |
| $t_{ri}$     |                                                                                                                                                                                              |                                                                                   | 150  | ns       |
| $E_{on}$     |                                                                                                                                                                                              |                                                                                   | 8    | mJ       |
| $t_{d(off)}$ |                                                                                                                                                                                              |                                                                                   | 400  | ns       |
| $t_{fi}$     |                                                                                                                                                                                              |                                                                                   | 700  | ns       |
| $E_{off}$    |                                                                                                                                                                                              | Note 1                                                                            | 15   | mJ       |
| $R_{thJC}$   |                                                                                                                                                                                              |                                                                                   |      | 0.42 K/W |
| $R_{thCK}$   |                                                                                                                                                                                              |                                                                                   | 0.15 | K/W      |

## TO-264 AA Outline



| Dim. | Millimeter |       | Inches   |       |
|------|------------|-------|----------|-------|
|      | Min.       | Max.  | Min.     | Max.  |
| A    | 4.82       | 5.13  | .190     | .202  |
| A1   | 2.54       | 2.89  | .100     | .114  |
| A2   | 2.00       | 2.10  | .079     | .083  |
| b    | 1.12       | 1.42  | .044     | .056  |
| b1   | 2.39       | 2.69  | .094     | .106  |
| b2   | 2.90       | 3.09  | .114     | .122  |
| c    | 0.53       | 0.83  | .021     | .033  |
| D    | 25.91      | 26.16 | 1.020    | 1.030 |
| E    | 19.81      | 19.96 | .780     | .786  |
| e    | 5.46 BSC   |       | .215 BSC |       |
| J    | 0.00       | 0.25  | .000     | .010  |
| K    | 0.00       | 0.25  | .000     | .010  |
| L    | 20.32      | 20.83 | .800     | .820  |
| L1   | 2.29       | 2.59  | .090     | .102  |
| P    | 3.17       | 3.66  | .125     | .144  |
| Q    | 6.07       | 6.27  | .239     | .247  |
| Q1   | 8.38       | 8.69  | .330     | .342  |
| R    | 3.81       | 4.32  | .150     | .170  |
| R1   | 1.78       | 2.29  | .070     | .090  |
| S    | 6.04       | 6.30  | .238     | .248  |
| T    | 1.57       | 1.83  | .062     | .072  |

| Symbol     | Test Conditions                                                                                                                                                                                                                                | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |          |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|----------|
|            |                                                                                                                                                                                                                                                | min.                                                                              | typ. | max.     |
| $V_F$      | $I_F = I_{C90}$ , $V_{GE} = 0\text{ V}$ , Pulse test,<br>$t \leq 300\text{ }\mu\text{s}$ , duty cycle $d \leq 2\%$ , $T_J = 125^\circ\text{C}$                                                                                                 |                                                                                   |      | 2.35 V   |
| $I_{RM}$   | $I_F = I_{C90}$ , $V_{GE} = 0\text{ V}$ , $-di_F/dt = 480\text{ A}/\mu\text{s}$<br>$V_R = 540\text{ V}$ $T_J = 100^\circ\text{C}$<br>$I_F = 1\text{ A}$ ; $-di_F/dt = 200\text{ A}/\mu\text{s}$ ; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$ |                                                                                   | 32   | 36 A     |
| $t_{rr}$   |                                                                                                                                                                                                                                                |                                                                                   | 225  | ns       |
| $R_{thJC}$ |                                                                                                                                                                                                                                                |                                                                                   | 40   | 60 ns    |
| $R_{thJC}$ |                                                                                                                                                                                                                                                |                                                                                   |      | 0.65 K/W |

IXSK 35N120AU1 characteristic curves are located in the IXSH 35N120A data sheet, Publication No. D96001DE, pages 66 - 67.