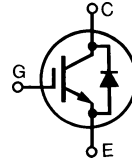


# HiPerFAST™ IGBT with Diode

Short Circuit SOA Capability

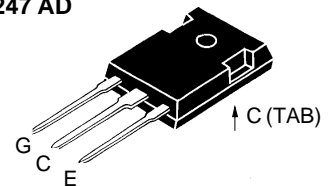
**IXSH 24N60U1**  
**IXSH24N60AU1**

$V_{CES}$	$I_{C25}$	$V_{CE(sat)}$
<b>600 V</b>	<b>48 A</b>	<b>2.2 V</b>
<b>600 V</b>	<b>48 A</b>	<b>2.7 V</b>



Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ 600	V	
$V_{CGR}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GE} = 1\text{ M}\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$	48	A
$I_{C90}$	$T_C = 90^\circ\text{C}$	24	A
$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1 ms	96	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15\text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 10\ \Omega$ Clamped inductive load, $L = 100\ \mu\text{H}$	$I_{CM} = 48$ @ $0.8\ V_{CES}$	A
<b><math>t_{SC}</math> (SCSOA)</b>	$V_{GE} = 15\text{ V}$ , $V_{CE} = 360\text{ V}$ , $T_J = 125^\circ\text{C}$ , $R_G = 82\ \Omega$ , non-repetitive	10	$\mu\text{s}$
$P_C$	$T_C = 25^\circ\text{C}$	150	W
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
$M_d$	Mounting torque, TO-247	1.13/10 Nm/lb.in.	
<b>Weight</b>		TO-247 AD	6 g

TO-247 AD



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

## Features

- International standard package JEDEC TO-247 AD
- 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

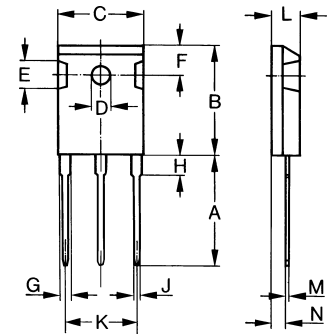
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

## Advantages

- Space savings (two devices in one package)
- Suitable for surface mounting
- Easy to mount with 1 screw, TO-247 (isolated mounting screw hole)
- Reduces assembly time and cost

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$BV_{CES}$	$I_C = 750\ \mu\text{A}$ , $V_{GE} = 0\text{ V}$	600		V
$V_{GE(th)}$	$I_C = 1.5\text{ mA}$ , $V_{CE} = V_{GE}$	3.5		6.5 V
$I_{CES}$	$V_{CE} = 0.8 \cdot V_{CES}$ , $T_J = 25^\circ\text{C}$ $V_{GE} = 0\text{ V}$ , $T_J = 125^\circ\text{C}$			500 $\mu\text{A}$ 8 mA
$I_{GES}$	$V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$	IXSH 24N60U1 IXSH 24N60AU1		2.2 V 2.7 V

Symbol	Test Conditions	Characteristic Values		
		(T <sub>J</sub> = 25°C, unless otherwise specified)		
		min.	typ.	max.
<b>g<sub>fs</sub></b>	I <sub>C</sub> = I <sub>C90</sub> ; V <sub>CE</sub> = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 %	9	13	S
<b>I<sub>C(on)</sub></b>	V <sub>GE</sub> = 15 V, V <sub>CE</sub> = 10 V		65	A
<b>C<sub>ies</sub></b> <b>C<sub>oes</sub></b> <b>C<sub>res</sub></b>	V <sub>CE</sub> = 25 V, V <sub>GE</sub> = 0 V, f = 1 MHz		1800	pF
			200	pF
			45	pF
<b>Q<sub>g</sub></b> <b>Q<sub>ge</sub></b> <b>Q<sub>gc</sub></b>	I <sub>C</sub> = I <sub>C90</sub> , V <sub>GE</sub> = 15 V, V <sub>CE</sub> = 0.5 V <sub>CES</sub>		75	nC
			20	nC
			35	nC
<b>t<sub>d(on)</sub></b> <b>t<sub>ri</sub></b> <b>t<sub>d(off)</sub></b> <b>t<sub>fi</sub></b> <b>E<sub>off</sub></b>	<b>Inductive load, T<sub>J</sub> = 25°C</b> I <sub>C</sub> = I <sub>C90</sub> , V <sub>GE</sub> = 15 V, L = 100 μH, V <sub>CE</sub> = 0.8 V <sub>CES</sub> , R <sub>G</sub> = R <sub>off</sub> = 10 Ω Remarks: Switching times may increase for V <sub>CE</sub> (Clamp) > 0.8 • V <sub>CES</sub> , higher T <sub>J</sub> or increased R <sub>G</sub>		100	ns
			200	ns
			450	ns
		24N60U1	500	ns
		24N60AU1	275	ns
	24N60AU1	2	mJ	
<b>t<sub>d(on)</sub></b> <b>t<sub>ri</sub></b> <b>E<sub>on</sub></b> <b>t<sub>d(off)</sub></b> <b>t<sub>fi</sub></b> <b>E<sub>off</sub></b>	<b>Inductive load, T<sub>J</sub> = 125°C</b> I <sub>C</sub> = I <sub>C90</sub> , V <sub>GE</sub> = 15 V, L = 100 μH, V <sub>CE</sub> = 0.8 V <sub>CES</sub> , R <sub>G</sub> = R <sub>off</sub> = 10 Ω Remarks: Switching times may increase for V <sub>CE</sub> (Clamp) > 0.8 • V <sub>CES</sub> , higher T <sub>J</sub> or increased R <sub>G</sub>		100	ns
			200	ns
			1.8	mJ
			475	ns
		24N60U1	600	ns
		24N60AU1	450	ns
	24N60U1	4	mJ	
	24N60AU1	3	mJ	
<b>R<sub>thJC</sub></b> <b>R<sub>thCK</sub></b>			0.83 K/W	K/W
		0.25		

**TO-247 AD (IXSH) Outline**


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Symbol	Test Conditions	Characteristic Values		
		(T <sub>J</sub> = 25°C, unless otherwise specified)		
		min.	typ.	max.
<b>V<sub>F</sub></b>	I <sub>F</sub> = I <sub>C90</sub> , V <sub>GE</sub> = 0 V, Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 %			1.6 V
<b>I<sub>RM</sub></b> <b>t<sub>rr</sub></b>	I <sub>F</sub> = I <sub>C90</sub> , V <sub>GE</sub> = 0 V, -di <sub>F</sub> /dt = 240 A/μs V <sub>R</sub> = 360 V I <sub>F</sub> = 1 A; -di/dt = 100 A/μs; V <sub>R</sub> = 30 V		10	15 A
		T <sub>J</sub> = 125°C	150	ns
		T <sub>J</sub> = 25°C	35	50 ns
<b>R<sub>thJC</sub></b>				1 K/W