

# JHH75N60HE

## *Product Preview*

**600V/75A HIGH SPEED FIELD-STOP TRENCH IGBT  
WITH DIODE**

## Features

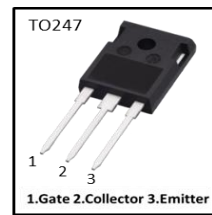
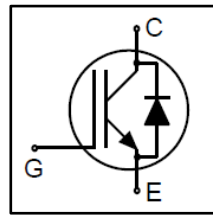
- Low  $V_{CE(sat)}$
- Fast Switching
- High Ruggedness



Product Summary	
$V_{CES}$	600V
$I_c$	75A <sup>(1)</sup>
$V_{CE(sat),typ.}$	1.55V ( $T_J = 25^\circ\text{C}$ )
Package	TO-247

## Applications

- Solar converters
- Uninterruptible power supplies (UPS)
- High-frequency converters
- Power factor correction (PFC)



## Ordering Information

Part Number	Marking	Package	Packing
JHH75N60HE	HH75N60HE	TO-247	Tube

**Absolute Maximum Ratings**

Parameter	Symbol	Limit	Unit
Collector-to-Emitter Voltage	$V_{CES}$	600	V
Gate-to-Emitter Voltage	$V_{GES}$	$\pm 20$	
DC Collector Current ( $T_c = 25^\circ\text{C}$ , $T_J = 175^\circ\text{C}$ )	$I_C$	80 <sup>(2)</sup>	A
DC Collector Current ( $T_c = 100^\circ\text{C}$ , $T_J = 175^\circ\text{C}$ )		80	
Pulsed Collector Current (pulse width limited by maximum $T_J$ )	$I_{CM}$	300	
Diode Forward Current ( $T_c = 25^\circ\text{C}$ , $T_J = 175^\circ\text{C}$ )	$I_F$	80 <sup>(2)</sup>	
Diode Forward Current ( $T_c = 100^\circ\text{C}$ , $T_J = 175^\circ\text{C}$ )		80 <sup>(2)</sup>	
Diode Pulsed Current (pulse width limited by maximum $T_J$ )	$I_{FM}$	300	
Maximum Power Dissipation ( $T_c = 25^\circ\text{C}$ , $T_J = 175^\circ\text{C}$ )	$P_{D(max)}$	429	
Operating Junction Temperature	$T_J$	-40 to +175	°C
Storage Temperature	$T_{stg}$	-55 to +150	

**Static Electrical Characteristics <sup>(3)</sup>**

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Unit
Collector-to-Emitter Breakdown Voltage	$BV_{CES}$	$V_{GE} = 0V$ , $I_C = 250\mu\text{A}$	600	-	-	V
Collector-to-Emitter Leakage Current	$I_{CES}$	$V_{CE} = 600V$ , $V_{GE} = 0V$	-	-	10	$\mu\text{A}$
		$V_{CE} = 600V$ , $V_{GE} = 0V$ $T_J = 175^\circ\text{C}$	-	-	5	mA
Gate-to-Emitter Leakage Current	$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$	-	-	100	nA
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$ , $I_C = 250\mu\text{A}$	4.0	5.0	6.0	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15V$ , $I_C = 75A$	-	1.55	1.9	V
		$V_{GE} = 15V$ , $I_C = 75A$ , $T_J = 175^\circ\text{C}$	-	2.15	-	
Diode Forward Voltage	$V_F$	$V_{GE} = 0V$ , $I_F = 75A$	-	1.7	2.1	V
		$V_{GE} = 0V$ , $I_F = 75A$ $T_J = 175^\circ\text{C}$	-	1.3	-	

**Thermal Characteristics**

Parameter	Symbol	Min	Typ	Max	Unit
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	-	-	40	°C/W
Junction-to-Case Thermal Resistance, IGBT	$R_{\theta IC}$	-	-	0.35	
Junction-to-Case Thermal Resistance, Diode		-	-	0.33	

**Dynamic Electrical Characteristics <sup>(3)</sup>**

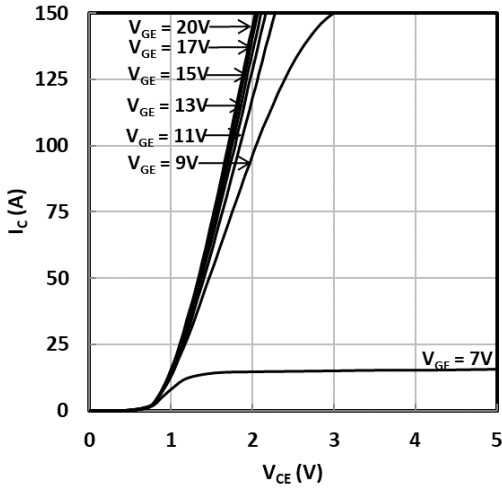
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Total Gate Charge	$Q_g$	$V_{CC} = 300V,$ $V_{GE} = 15V,$ $I_C = 75A$	-	200	-	nC
Input Capacitance	$C_{iss}$	$V_{CE} = 25V,$ $V_{GE} = 0V,$ $f = 1MHz$	-	4463	-	pF
Output Capacitance	$C_{oss}$		-	294	-	
Reverse Transfer Capacitance	$C_{rss}$		-	68	-	

**Switching Characteristics, Inductive Load** <sup>(3), (4)</sup>

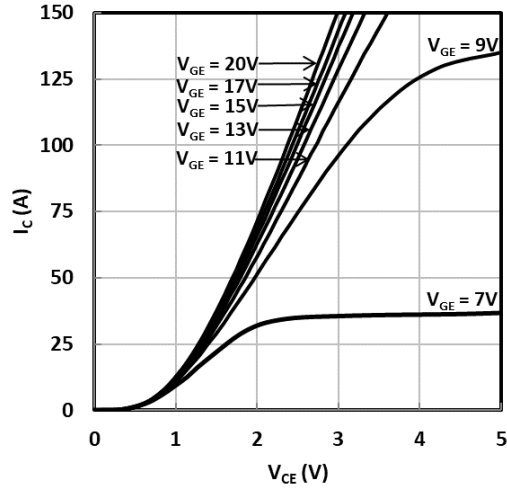
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(ON)}$	$V_{CC} = 300V,$ $V_{GE} = 0/15V,$ $R_G = 4.7\Omega,$ $I_C = 37.5A,$ $L_{load} = 0.82mH$ (Energy losses include "tail" and FRD reverse recovery)	-	28	-	ns
Rise Time	$t_r$		-	26	-	
Turn-off delay time	$t_{d(OFF)}$		-	131	-	
Fall Time	$t_f$		-	21	-	
Turn-On Switching Loss	$E_{on}$	(Energy losses include "tail" and FRD reverse recovery)	-	0.52	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	0.26	-	
Total Switching Loss	$E_{ts}$		-	0.78	-	
Turn-on delay time	$t_{d(ON)}$	$V_{CC} = 300V,$ $V_{GE} = 0/15V,$ $R_G = 4.7\Omega,$ $I_C = 75A,$ $L_{load} = 0.82mH$ (Energy losses include "tail" and FRD reverse recovery)	-	26	-	ns
Rise Time	$t_r$		-	58	-	
Turn-off delay time	$t_{d(OFF)}$		-	118	-	
Fall Time	$t_f$		-	39	-	
Turn-On Switching Loss	$E_{on}$	(Energy losses include "tail" and FRD reverse recovery)	-	1.33	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	0.72	-	
Total Switching Loss	$E_{ts}$		-	2.05	-	

- (1)  $T_c = 110^\circ C, T_J = 175^\circ C.$
- (2) Limited by bonding wire.
- (3)  $T_J = 25^\circ C$  unless otherwise specified.
- (4)  $t_r$ : from 10% of  $I_C$  to 90% of  $I_C$ ;  $t_f$ : from 90% of  $I_C$  to 10% of  $I_C$ ;  
 $E_{on}$ : from 10% of  $V_{GE}$  to 10% of  $V_{CE}$ ;  $E_{off}$ : from 90% of  $V_{GE}$  to 10% of  $I_C$ .

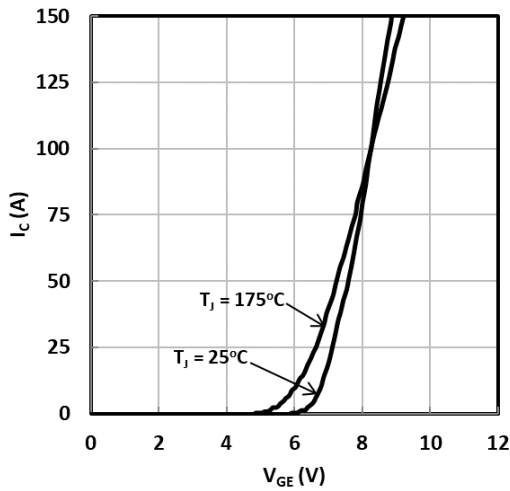
**Typical Electrical Characteristics**



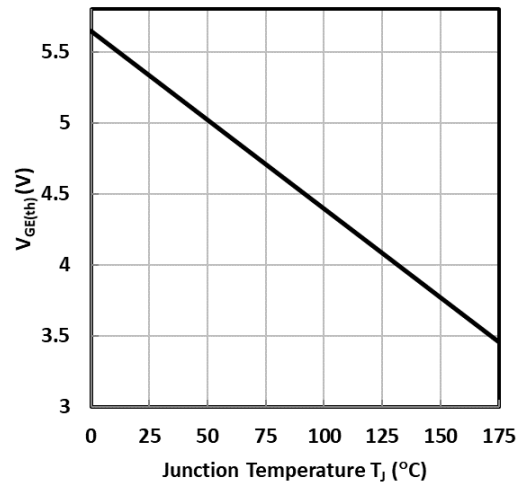
**Fig. 1 Typical output characteristics**  
( $T_j = 25^\circ\text{C}$ ,  $t_p = 250 \mu\text{s}$ )



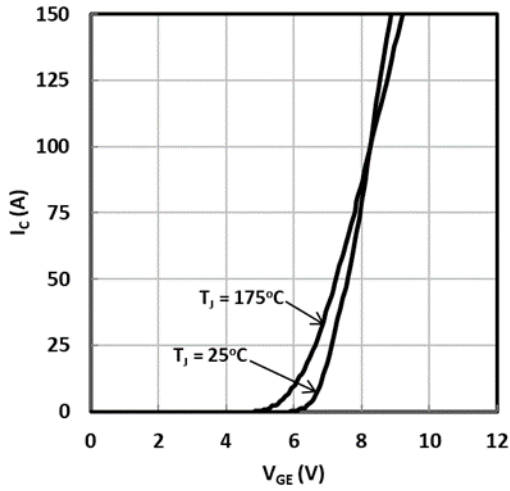
**Fig. 2 Typical output characteristics**  
( $T_j = 175^\circ\text{C}$ ,  $t_p = 250 \mu\text{s}$ )



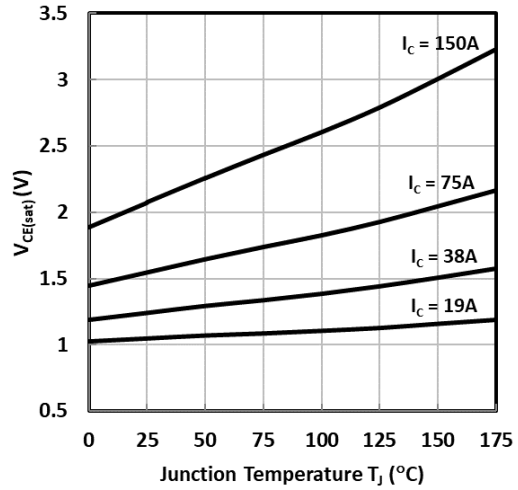
**Fig. 3 Typical transfer characteristics**  
( $V_{ce} = 10 \text{ V}$ ,  $t_p = 250 \mu\text{s}$ )



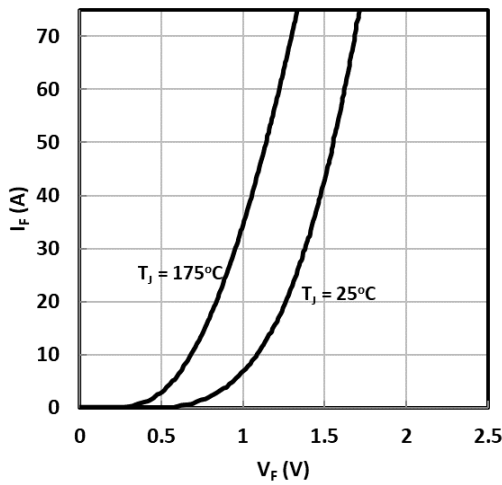
**Fig. 4 Typical gate threshold voltage as a function of junction temperature**  
( $V_{ce} = V_{ge}$ ,  $I_c = 1.5\text{mA}$ )



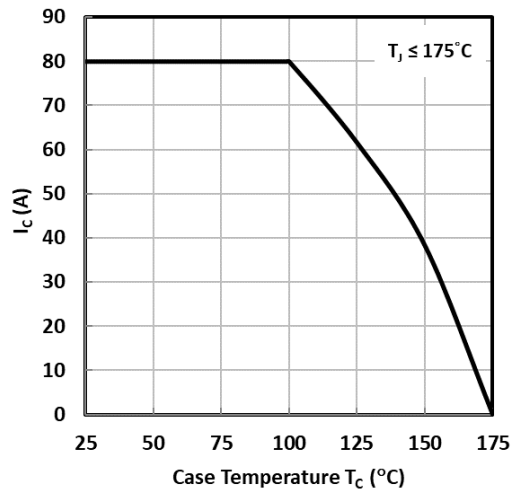
**Fig. 5 Typical saturation voltage characteristics**  
( $V_{GE} = 15\text{ V}$ ,  $t_p = 250\ \mu\text{s}$ )



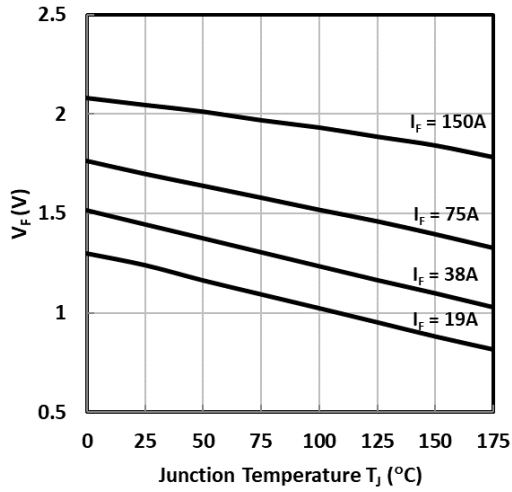
**Fig. 6 Typical saturation voltage as a function of junction temperature**  
( $V_{GE} = 15\text{ V}$ ,  $t_p = 250\ \mu\text{s}$ )



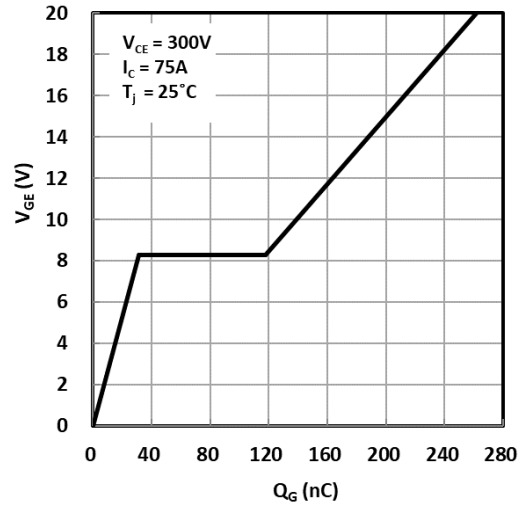
**Fig. 7 Typical diode forward current as a function of forward voltage**  
( $V_{GE} = 0\text{ V}$ ,  $t_p = 250\ \mu\text{s}$ )



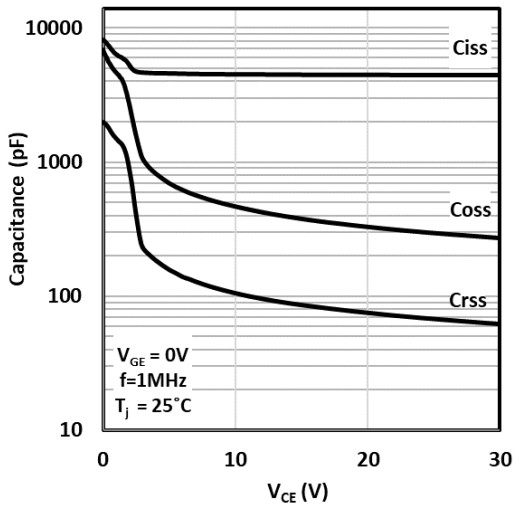
**Fig. 8 Maximum DC collector current as a function of case temperature**  
( $I_c$  limited by bonding wire)



**Fig. 9 Typical diode forward voltage as a function of junction temperature**  
( $V_{GE} = 0$  V,  $t_p = 250$   $\mu$ s)



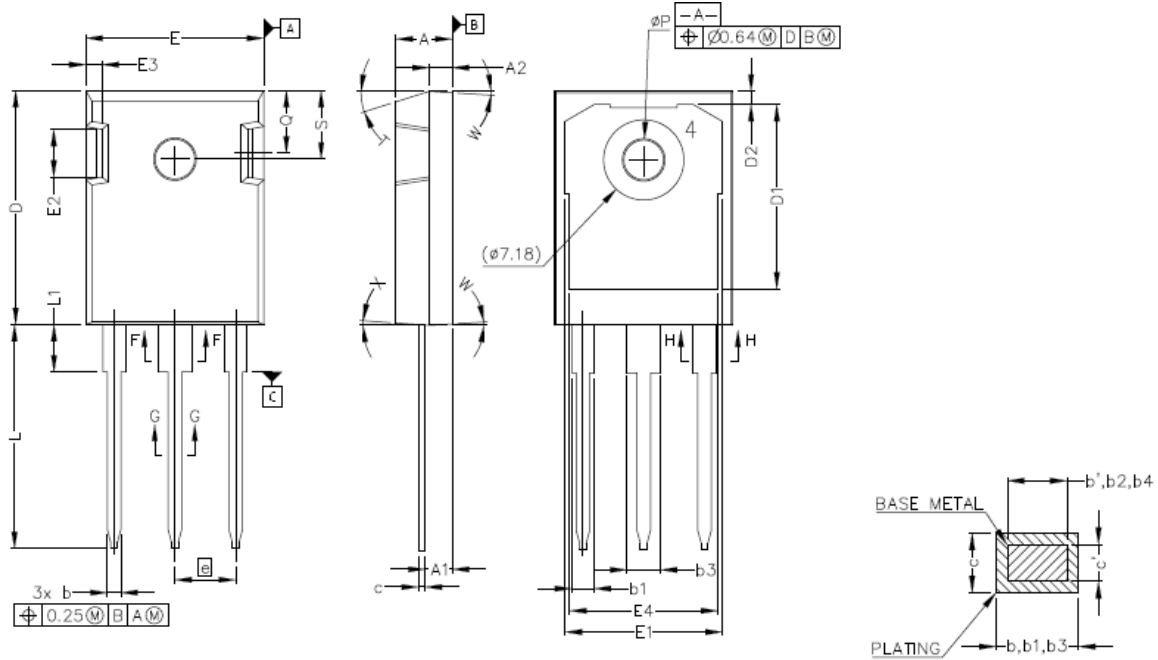
**Fig. 10 Typical gate charge characteristics**



**Fig. 11 Typical capacitance as a function of collector-to-emitter voltage**



Package Drawing



SYM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	.190	.205
A1	2.29	2.54	.090	.100
A2	1.91	2.16	.075	.085
b'	1.07	1.28	.042	.050
b	1.07	1.33	.042	.052
b1	1.91	2.41	.075	.095
b2	1.91	2.16	.075	.085
b3	2.87	3.38	.113	.133
b4	2.87	3.13	.113	.123
c'	0.55	0.65	.022	.026
c	0.55	0.68	.022	.027
D	20.80	21.10	.819	.831
D1	16.25	17.65	.640	.695
D2	0.95	1.25	.037	.049
E	15.75	16.13	.620	.635
E1	13.10	14.15	.516	.557
E2	3.68	5.10	.145	.201
E3	1.00	1.90	.039	.075
E4	12.38	13.43	.487	.529
e	5.44 BSC		.214 BSC	
N	3		3	
L	19.81	20.32	.780	.800
L1	4.10	4.40	.161	.173
$\phi P$	3.51	3.65	.138	.144
Q	5.49	6.00	.216	.236
S	6.04	6.30	.238	.248
T	17.5° REF.			
W	3.5° REF.			
X	4° REF.			

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