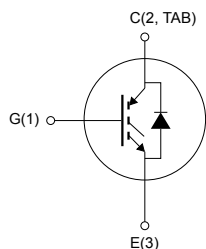
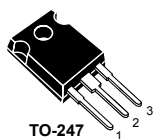
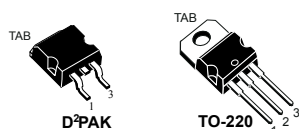




STGB19NC60HDT4, STGP19NC60HD, STGW19NC60HD

Datasheet

19 A, 600 V, very fast IGBT with ultra-fast diode



NG1E3C2T

Features

- Low on voltage drop ($V_{CE(sat)}$)
- Very soft ultra-fast recovery antiparallel diode

Applications

- High frequency motor controls
- SMPS and PFC in both hard switch and resonant topologies

Description

These devices are very fast IGBTs developed using advanced PowerMESH technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior.



Product status links

[STGB19NC60HDT4](#)

[STGP19NC60HD](#)

[STGW19NC60HD](#)

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK, TO-220	TO-247	
V _{CES}	Collector-emitter voltage (V _{GE} = 0 V)	600		V
I _C ⁽¹⁾	Continuous collector current at T _C = 25 °C	40	42	A
	Continuous collector current at T _C = 100 °C	19	21	
I _{CL} ⁽²⁾	Turn-off latching current	40		A
I _{CP} ⁽³⁾	Pulsed collector current	60		A
V _{GE}	Gate-emitter voltage	±20		V
I _F	Diode RMS forward current at T _C = 25 °C	20		A
I _{FSM}	Surge non repetitive forward current t _p = 10 ms sinusoidal	50		A
P _{TOT}	Total power dissipation at T _C = 25 °C	130	140	W
T _{stg}	Storage temperature range	-55 to 150		°C
T _J	Operating junction temperature range			°C

1. Calculated according to the iterative formula: $I_C(T_C) = \frac{T_{J(max)} - T_C}{R_{thJC} \times V_{CE(sat)(max)}(T_{J(max)}, I_C(T_C))}$
2. V_{clamp} = 80% V_{CES}, T_J = 150 °C, R_G = 10 Ω, V_{GE} = 15 V.
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA.

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		D ² PAK, TO-220	TO-247	
R _{thJC}	Thermal resistance, junction-to-case IGBT	0.95	0.9	°C/W
	Thermal resistance, junction-to-case diode	3	3	
R _{thJA}	Thermal resistance, junction-to-ambient	62.5	50	°C/W

2 Electrical characteristics

$T_C = 25\text{ °C}$ unless otherwise specified

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$	600	-	-	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 12\text{ A}$	-	1.8	2.5	V
		$V_{GE} = 15\text{ V}$, $I_C = 15\text{ A}$	-	2	-	
		$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$, $T_J = 100\text{ °C}$	-	2.5	-	
		$V_{GE} = 15\text{ V}$, $I_C = 12\text{ A}$, $T_J = 125\text{ °C}$	-	1.6	-	
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	3.75	-	5.75	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$	-	-	0.15	mA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 125\text{ °C}^{(1)}$	-	-	1	
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$	-	-	± 100	nA
$g_{fs}^{(2)}$	Forward transconductance	$V_{CE} = 15\text{ V}$, $I_C = 12\text{ A}$	-	5	-	S

1. Specified by design, not tested in production.

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	1180	-	pF
C_{oes}	Output capacitance		-	130	-	pF
C_{res}	Reverse transfer capacitance		-	36	-	pF
Q_g	Total gate charge	$V_{CC} = 390\text{ V}$, $I_C = 5\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (see the Figure 19. Gate charge test circuit)	-	53	-	nC
Q_{ge}	Gate-emitter charge		-	10	-	nC
Q_{gc}	Gate-collector charge		-	23	-	nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see the Figure 20. Switching waveform)	-	25	-	ns
t_r	Current rise time		-	7	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1600	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see the Figure 20. Switching waveform)	-	24	-	ns
t_r	Current rise time		-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1400	-	A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see the Figure 20. Switching waveform)	-	27	-	ns
$t_{d(off)}$	Turn-off delay time		-	97	-	ns
t_f	Current fall time		-	73	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see the Figure 20. Switching waveform)	-	58	-	ns
$t_{d(off)}$	Turn-off delay time		-	144	-	ns
t_f	Current fall time		-	128	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see the Figure 20. Switching waveform)	-	85	-	μ J
$E_{off}^{(1)}$	Turn-off switching energy		-	189	-	μ J
E_{ts}	Total switching energy		-	274	-	μ J
E_{on}	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see the Figure 20. Switching waveform)	-	187	-	μ J
$E_{off}^{(1)}$	Turn-off switching energy		-	407	-	μ J
E_{ts}	Total switching energy		-	594	-	μ J

1. Including the tail of the collector current.

Table 7. Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 12\text{ A}$	-	2.6	-	V
		$I_F = 12\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$	-	2.1	-	
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}$, $V_R = 40\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see the Figure 18. Diode reverse recovery waveform)	-	31	-	ns
Q_{rr}	Reverse recovery charge		-	30	-	nC
I_{rrm}	Reverse recovery current		-	2	-	A
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}$, $V_R = 40\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 125\text{ }^\circ\text{C}$ (see the Figure 18. Diode reverse recovery waveform)	-	59	-	ns
Q_{rr}	Reverse recovery charge		-	102	-	nC
I_{rr}	Reverse recovery current		-	4	-	A

2.1 Electrical characteristics (curves)

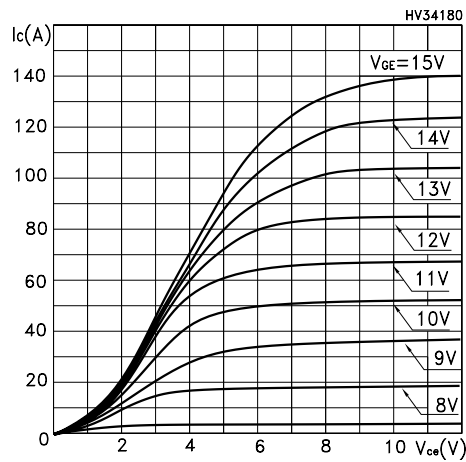
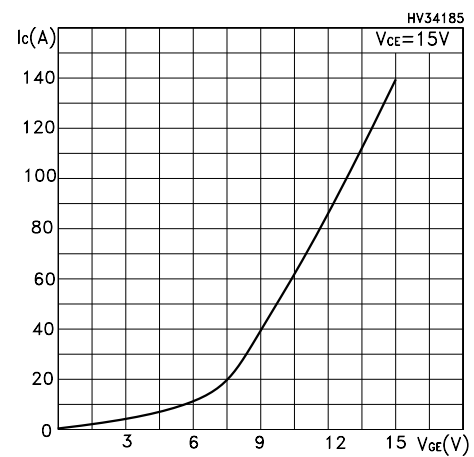
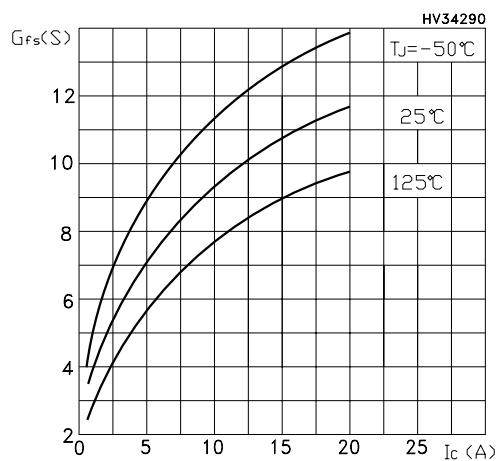
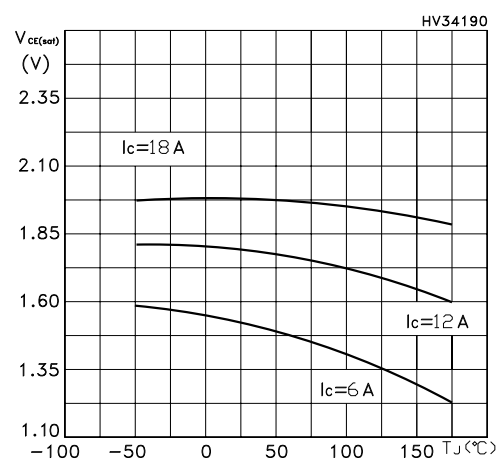
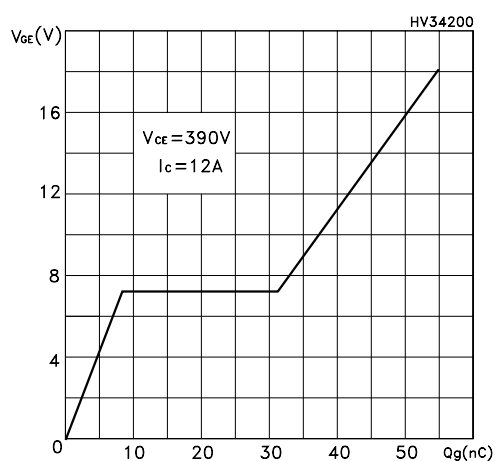
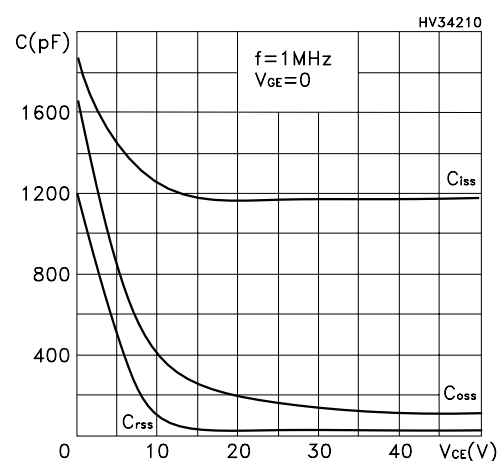
Figure 1. Typical output characteristics

Figure 2. Typical transfer characteristics

Figure 3. Typical transconductance characteristics

Figure 4. Typical collector-emitter on voltage vs temperature

Figure 5. Typical gate charge characteristics

Figure 6. Typical capacitance characteristics


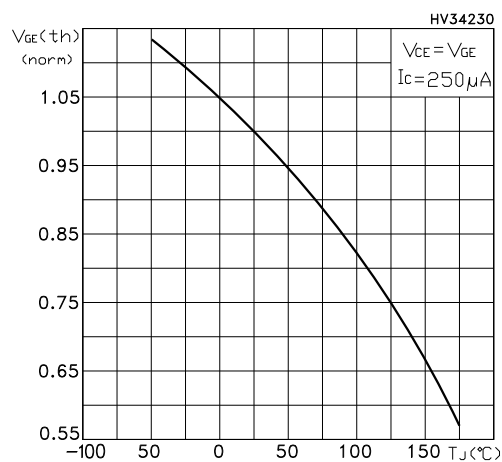
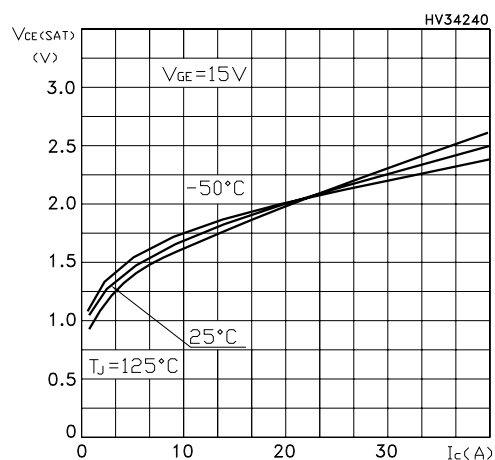
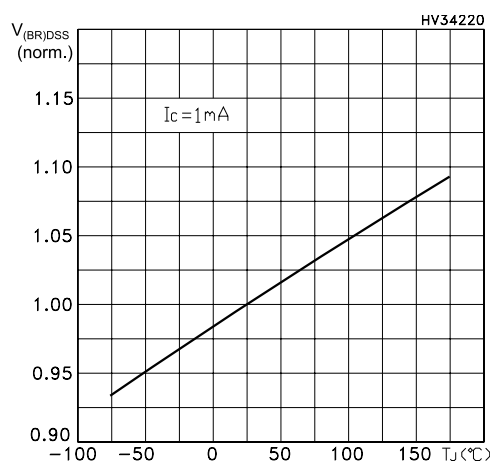
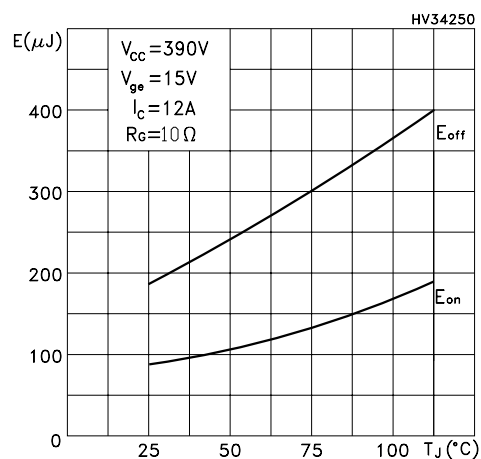
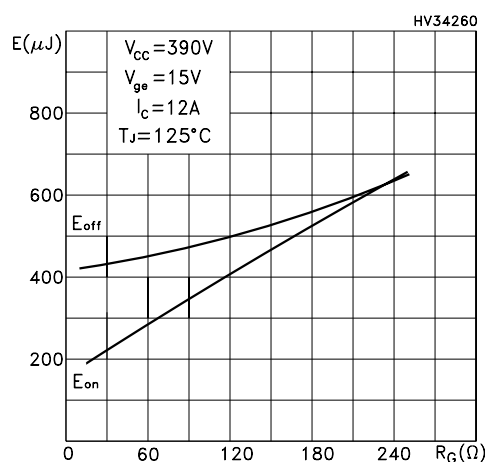
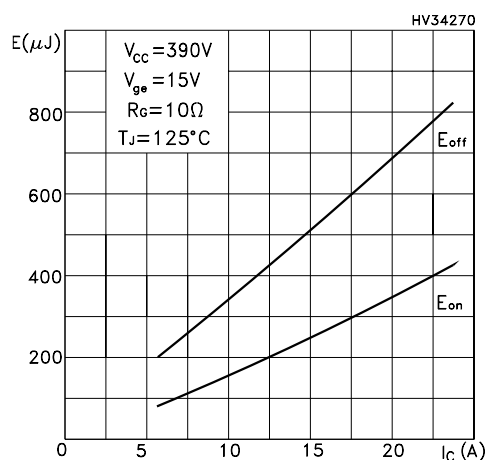
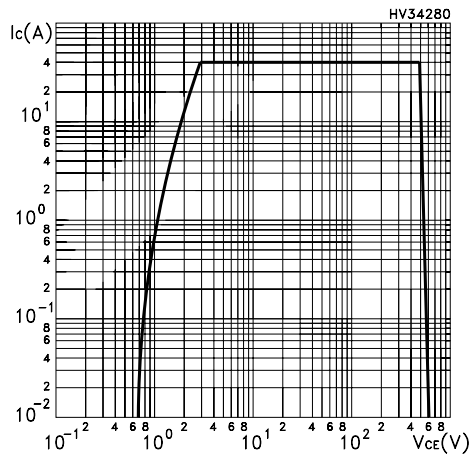
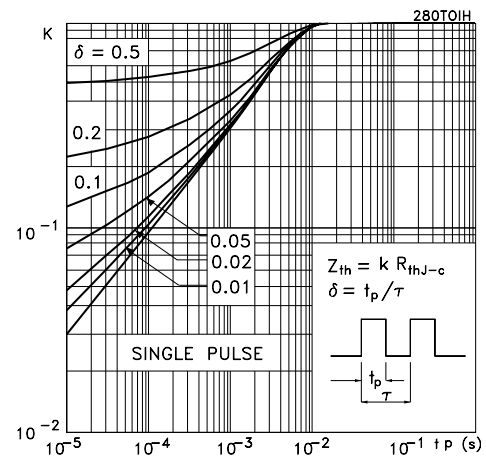
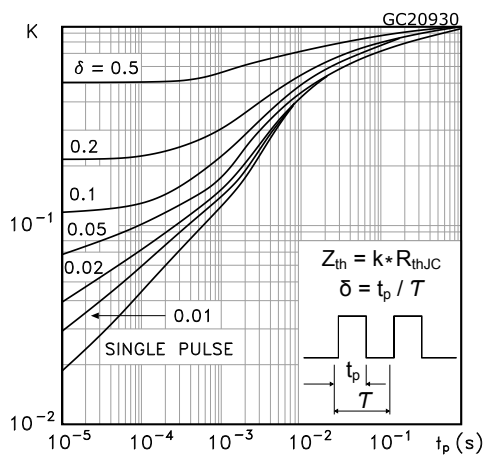
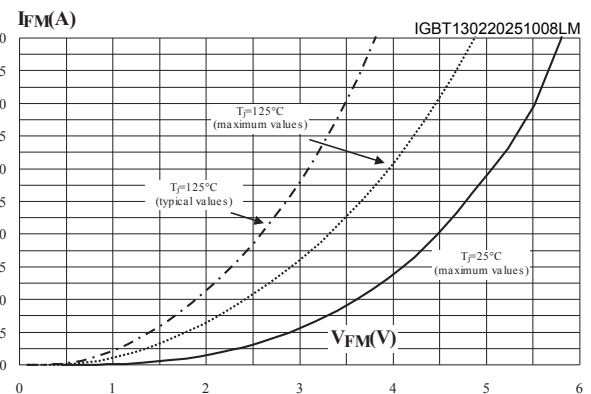
Figure 7. Normalized gate threshold vs temperature

Figure 8. Typical collector-emitter on voltage vs collector current

Figure 9. Normalized breakdown voltage vs temperature

Figure 10. Typical switching energy vs temperature

Figure 11. Typical switching energy vs gate resistance

Figure 12. Typical switching energy vs collector current


Figure 13. Reverse bias safe operating area

Figure 14. Normalized transient thermal impedance for D²PAK, TO-220

Figure 15. Normalized transient thermal impedance for TO-247

Figure 16. Typical emitter-collector diode characteristics


3 Test circuits

Figure 17. Test circuit for inductive load switching

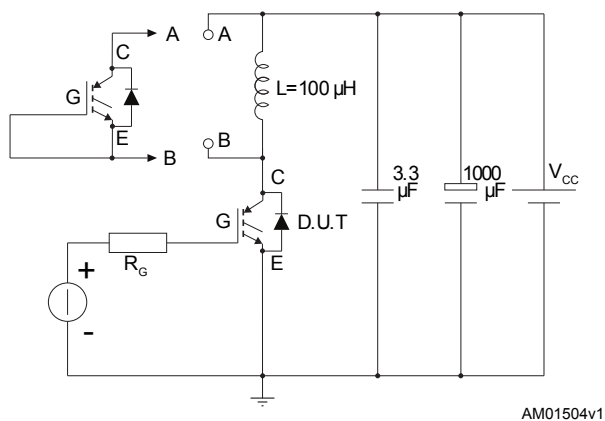


Figure 18. Diode reverse recovery waveform

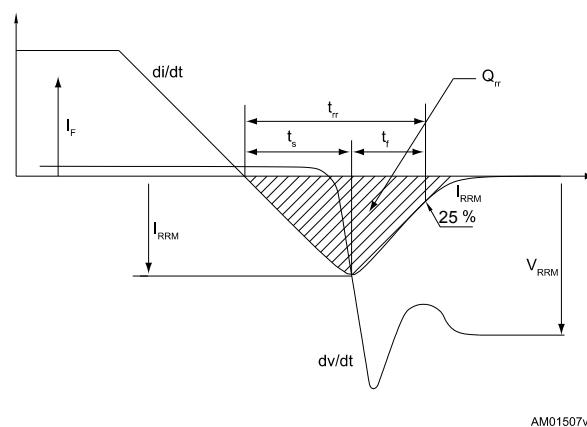


Figure 19. Gate charge test circuit

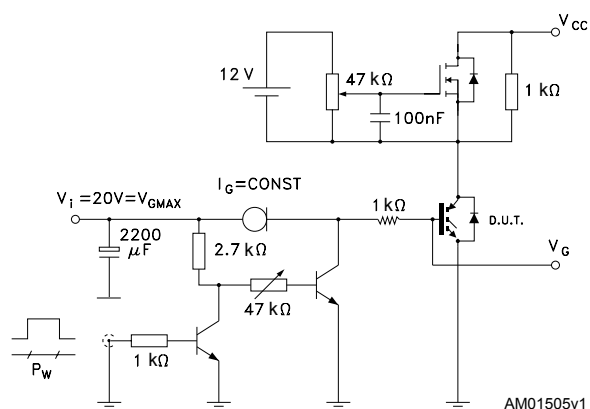
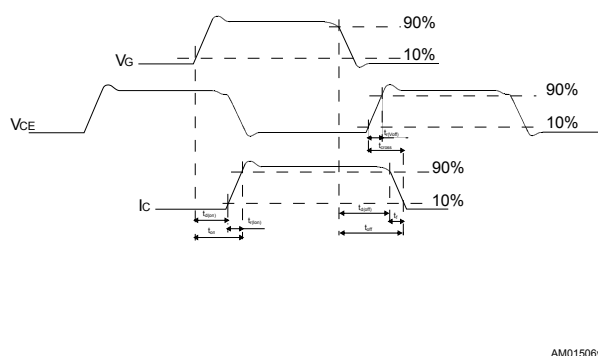


Figure 20. Switching waveform

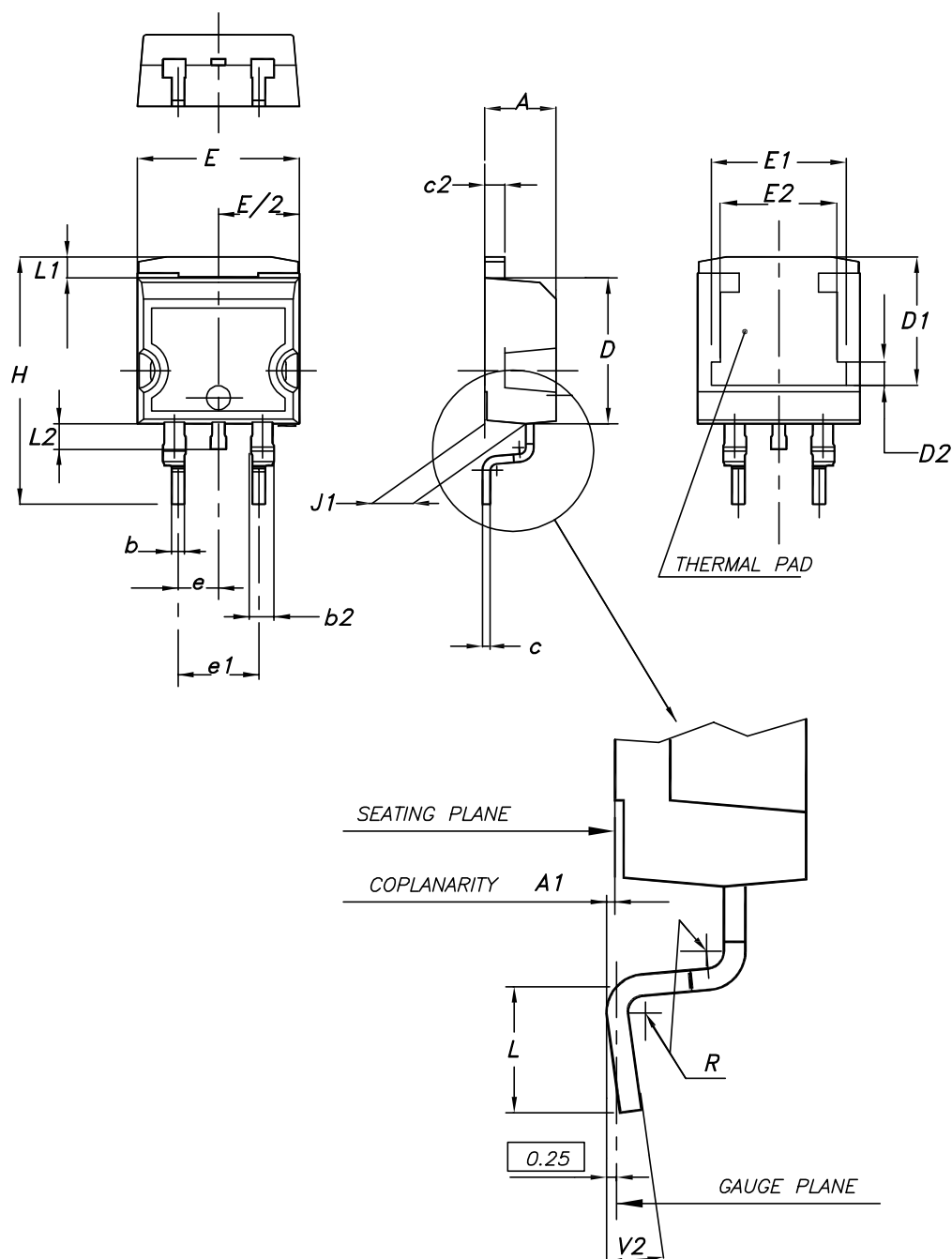


4 Package information

To meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions, and product status are available at: www.st.com. ECOPACK is an ST trademark.

4.1 D²PAK (TO-263) type A package information

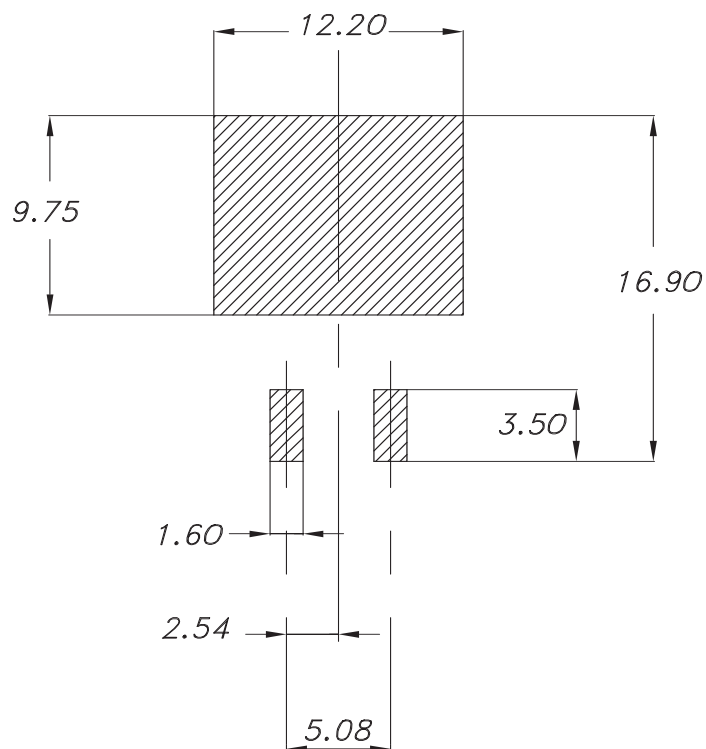
Figure 21. D²PAK (TO-263) type A package outline



0079457_27

Table 8. D²PAK (TO-263) type A package mechanical data

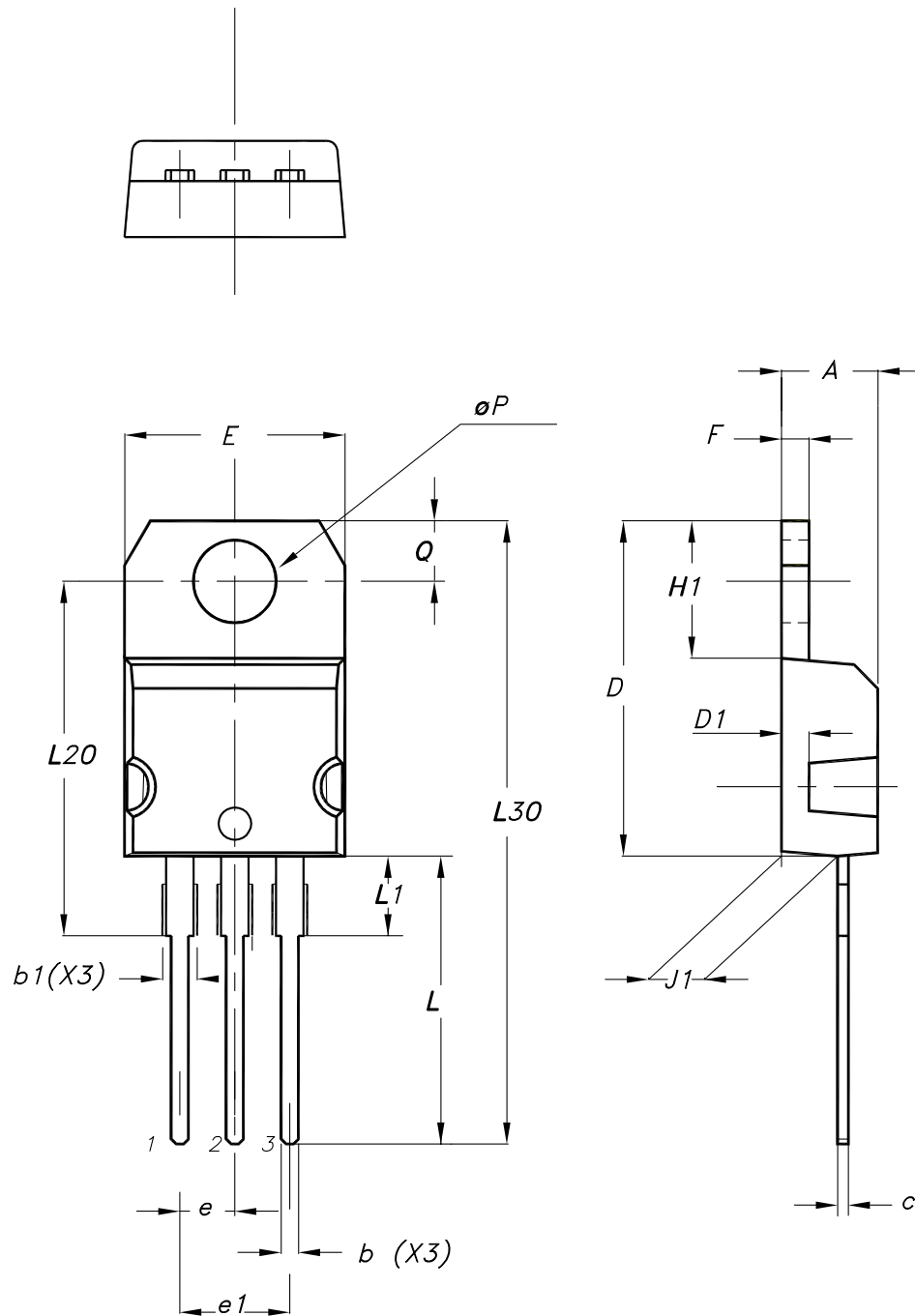
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 22. D²PAK (TO-263) recommended footprint (dimensions are in mm)


0079457_Rev27_footprint

4.2 TO-220 type A package information

Figure 23. TO-220 type A package outline



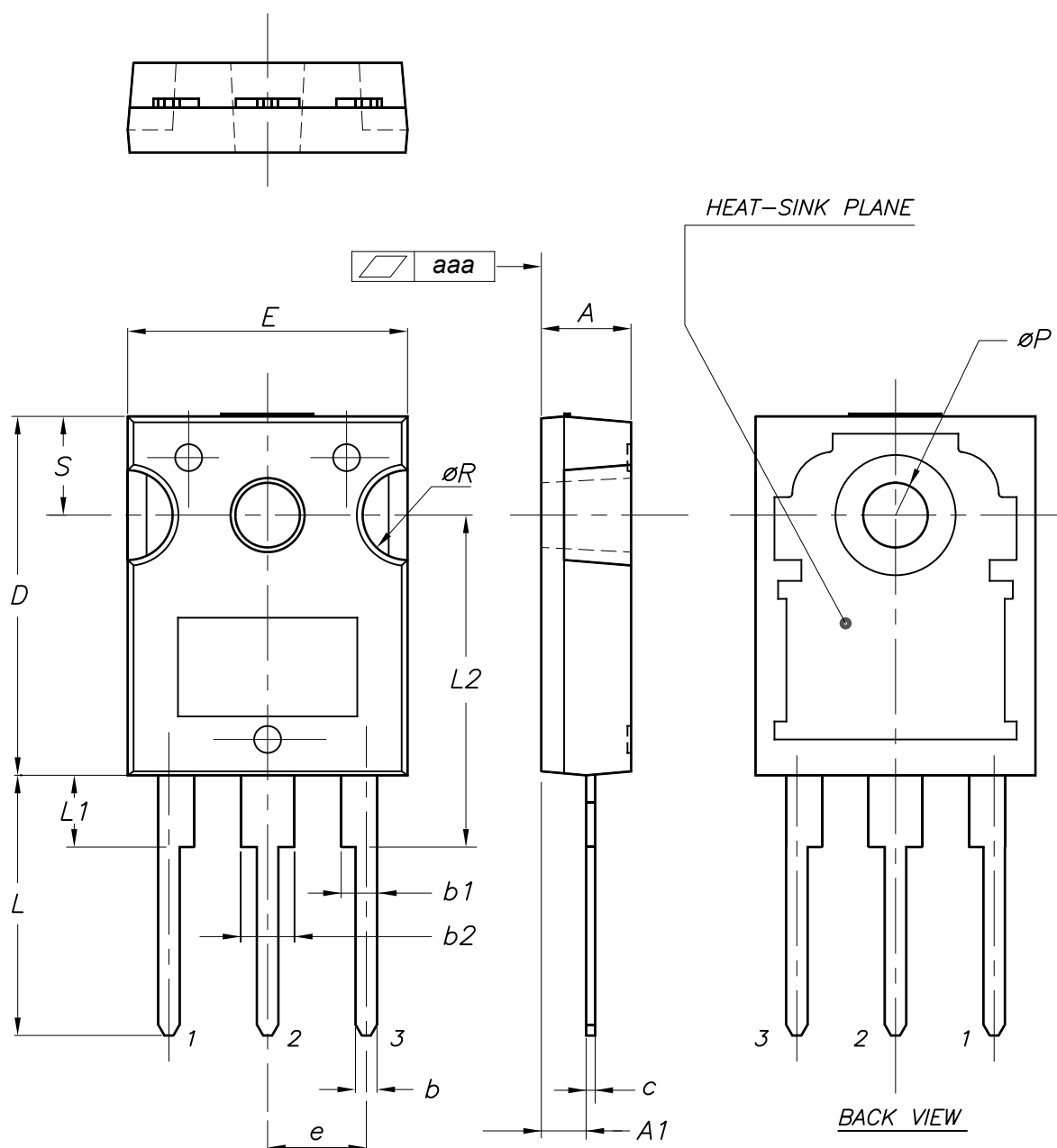
0015988_typeA_Rev_24

Table 9. TO-220 type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

4.3 TO-247 package information

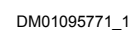
Figure 24. TO-247 package outline



0075325_10

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70
aaa		0.04	0.10

Figure 25. D²PAK tape drawing (dimensions are in mm)





5 Ordering information

Table 11. Order codes

Order codes	Marking	Package	Packing
STGB19NC60HDT4	GB19NC60HD	D ² PAK	Tape and reel
STGP19NC60HD	GP19NC60HD	TO-220	Tube
STGW19NC60HD	GW19NC60HD	TO-247	

Revision history

Table 12. Document revision history

Date	Revision	Changes
02-Nov-2006	1	First release.
05-Jan-2007	2	Complete version.
01-Jul-2008	3	Modified: <i>Table 2: Absolute maximum ratings</i> . Inserted new packages, mechanical data: TO-220FP, TO-247.
13-Oct-2008	4	V _{ISO} inserted in <i>Table 2</i> for TO-220FP.
15-May-2009	5	Updated I _{CP} value.
19-May-2009	6	Updated: mechanical data for TO-220FP.
24-Nov-2010	7	Inserted new order code STGWA19NC60HD in TO-247 long leads package.
14-Dec-2010	8	Updated <i>Table 4: Static</i> .
02-Sep-2011	9	Removed order code STGWA19NC60HD in TO-247 long leads package.
06-Sep-2016	10	Added <i>Section 5.2: TO-247 package information</i> . Minor text changes.
13-May-2025	11	Updated Section 4: Package information . Removed order code STGF19NC60HD in TO-2220FP.



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