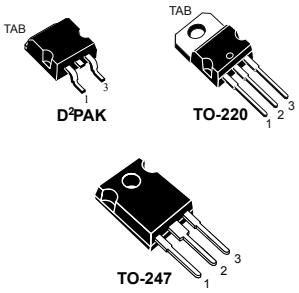
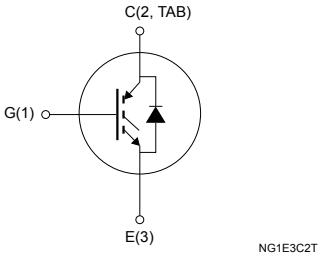
STGB19NC60HDT4, STGP19NC60HD, STGW19NC60HD

Datasheet

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





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
		D²PAK, 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:* $I_C(T_C) = \frac{T_{J(\max)} - T_C}{R_{thJC} \times V_{CE(sat)(\max)}\left(T_{J(\max)}, I_C(T_C)\right)}$
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
		D²PAK, 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 °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 V, I_C = 1 mA	600	-	-	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 12 A	-	1.8	2.5	V
		V_{GE} = 15 V, I_C = 15 A	-	2	-	
		V_{GE} = 15 V, I_C = 30 A, T_J = 100 °C	-	2.5	-	
		V_{GE} = 15 V, I_C = 12 A, T_J = 125 °C	-	1.6	-	
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	3.75	-	5.75	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 600 V	-	-	0.15	mA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 125 °C(1)	-	-	1	
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V	-	-	±100	nA
g_{fs}(2)	Forward transconductance	V_{CE} = 15 V, I_C = 12 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 V, f = 1 MHz, V_{GE} = 0 V	-	1180	-	pF
C_{oes}	Output capacitance		-	130	-	pF
C_{res}	Reverse transfer capacitance		-	36	-	pF
Q_g	Total gate charge	V_{CC} = 390 V, I_C = 5 A, V_{GE} = 0 to 15 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 V, I_C = 12 A,	-	25	-	ns
t_r	Current rise time	R_G = 10 Ω, V_{GE} = 15 V	-	7	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see the Figure 20. Switching waveform)	-	1600	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 12 A,	-	24	-	ns
t_r	Current rise time	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see the Figure 20. Switching waveform)	-	1400	-	A/µs
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 390 V, I_C = 12 A,	-	27	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 10 Ω, V_{GE} = 15 V	-	97	-	ns
t_f	Current fall time	(see the Figure 20. Switching waveform)	-	73	-	ns
$t_r(V_{off})$	Off voltage rise time	V_{CC} = 390 V, I_C = 12 A,	-	58	-	ns
$t_{d(off)}$	Turn-off delay time	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	144	-	ns
t_f	Current fall time	(see the Figure 20. Switching waveform)	-	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 V, I_C = 3 A,	-	85	-	µJ
E_{off}(1)	Turn-off switching energy	R_G = 10 Ω, V_{GE} = 15 V	-	189	-	µJ
E_{ts}	Total switching energy	(see the Figure 20. Switching waveform)	-	274	-	µJ
E_{on}	Turn-on switching energy	V_{CE} = 390 V, I_C = 3 A,	-	187	-	µJ
E_{off}(1)	Turn-off switching energy	R_G = 10 Ω, V_{GE} = 15 V, T_J = 125 °C	-	407	-	µJ
E_{ts}	Total switching energy	(see the Figure 20. Switching waveform)	-	594	-	µJ

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 = 12A	-	2.6	-	V
		I_F= 12 A, T_J=125 °C	-	2.1	-	
t_{rr}	Reverse recovery time	I_F = 12 A, V_R = 40 V, di/dt = 100 A/µs	-	31	-	ns
Q_{rr}	Reverse recovery charge	(see the Figure 18. Diode reverse recovery waveform)	-	30	-	nC
I_{rrm}	Reverse recovery current		-	2	-	A
t_{rr}	Reverse recovery time	I_F = 12 A, V_R = 40 V, di/dt = 100 A/µs,	-	59	-	ns
Q_{rr}	Reverse recovery charge	T_J = 125 °C	-	102	-	nC
I_{rr}	Reverse recovery current	(see the Figure 18. Diode reverse recovery waveform)	-	4	-	A

2.1 Electrical characteristics (curves)

Figure 1. Typical output characteristics

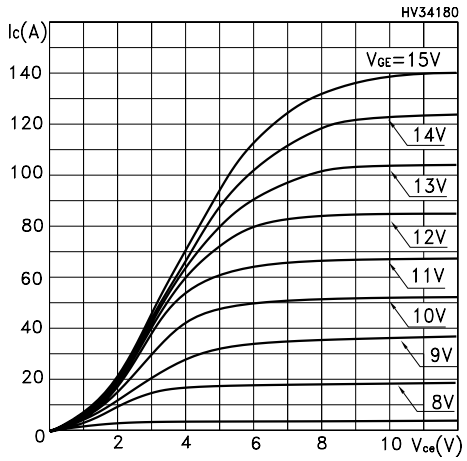


Figure 2. Typical transfer characteristics

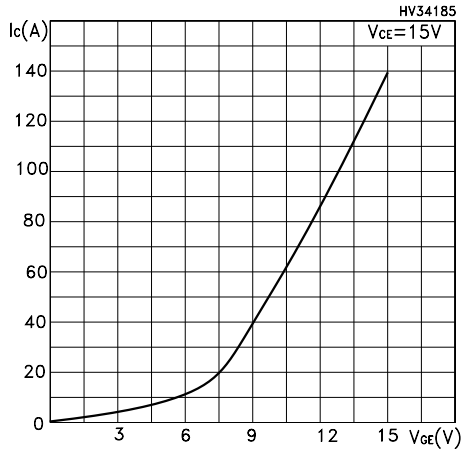


Figure 3. Typical transconductance characteristics

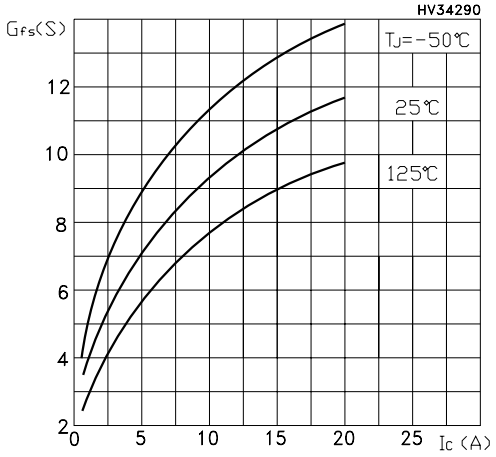


Figure 4. Typical collector-emitter on voltage vs temperature

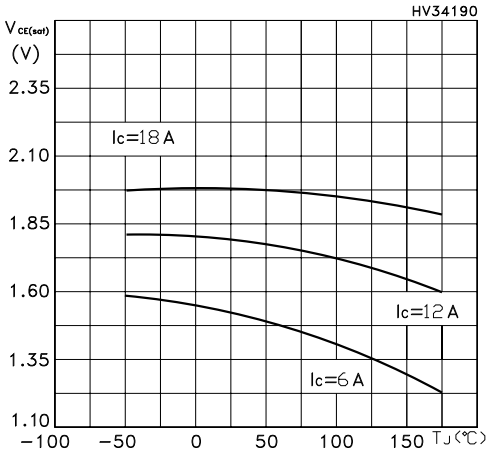


Figure 5. Typical gate charge characteristics

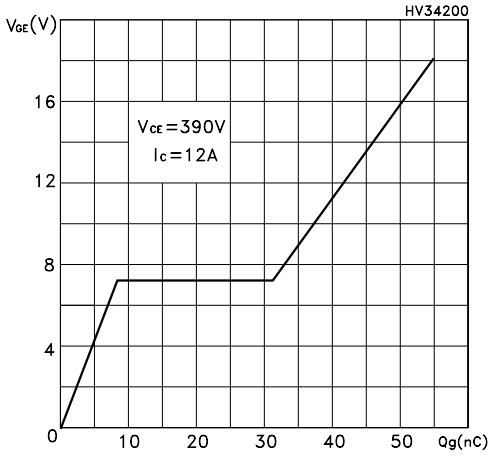


Figure 6. Typical capacitance characteristics

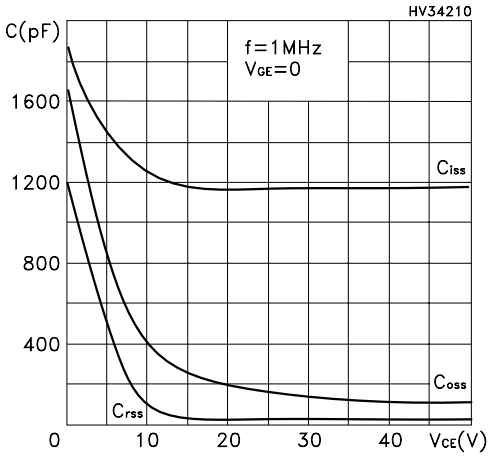


Figure 7. Normalized gate threshold vs temperature

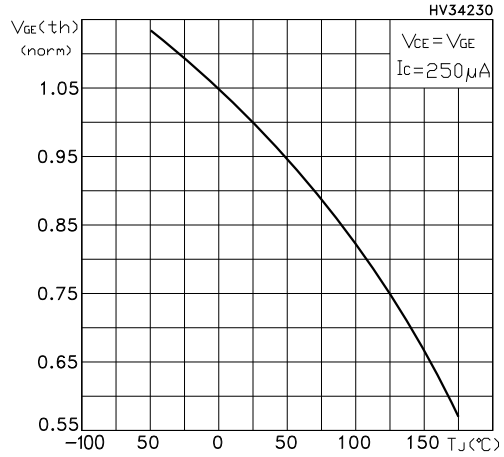


Figure 8. Typical collector-emitter on voltage vs collector current

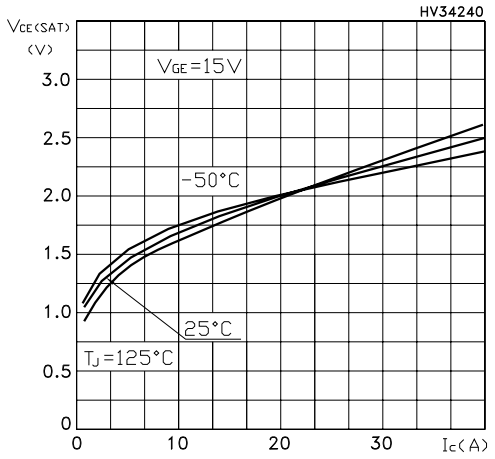


Figure 9. Normalized breakdown voltage vs temperature

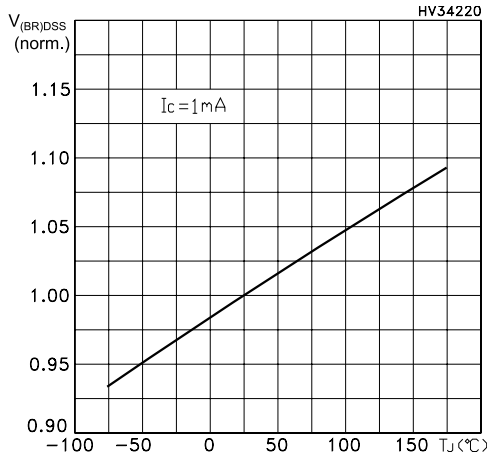


Figure 10. Typical switching energy vs temperature

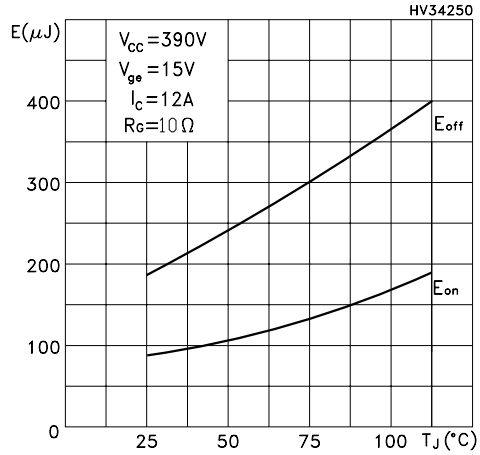


Figure 11. Typical switching energy vs gate resistance

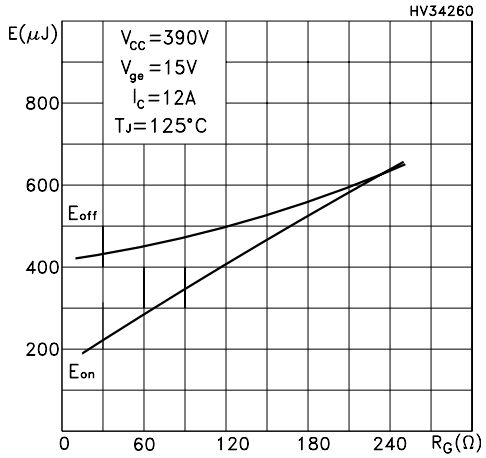


Figure 12. Typical switching energy vs collector current

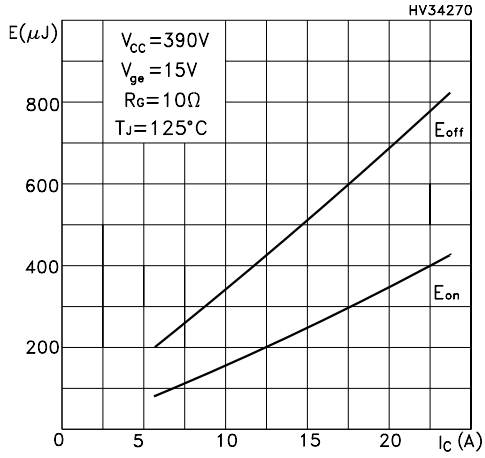


Figure 13. Reverse bias safe operating area

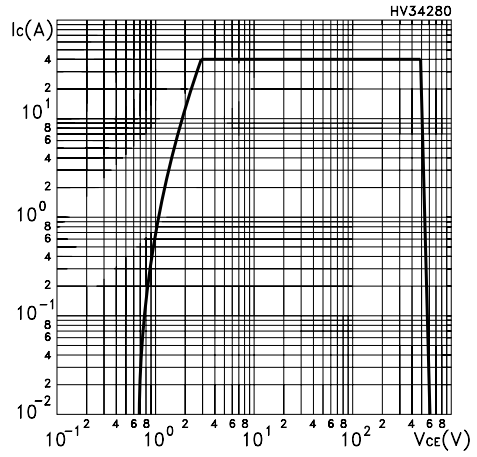


Figure 14. Normalized transient thermal impedance for D²PAK, TO-220

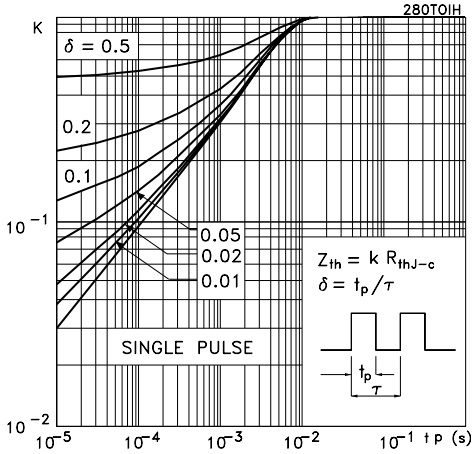


Figure 15. Normalized transient thermal impedance for TO-247

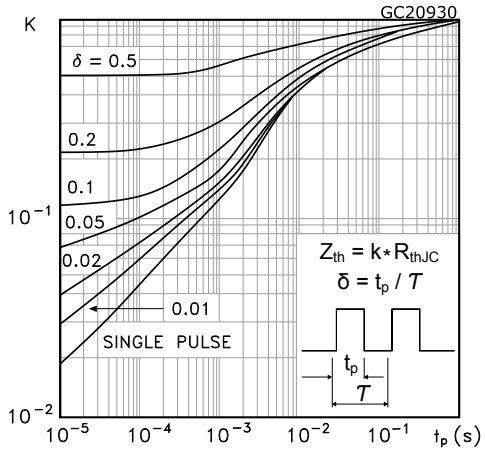
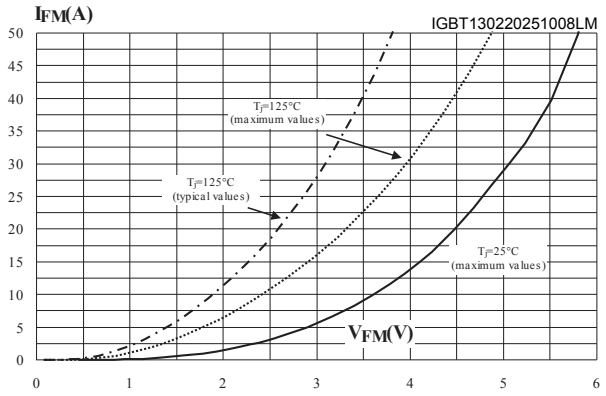


Figure 16. Typical emitter-collector diode characteristics



3 Test circuits

Figure 17. Test circuit for inductive load switching

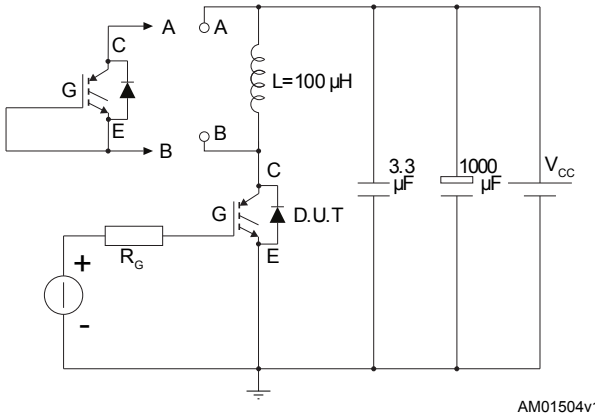


Figure 18. Diode reverse recovery waveform

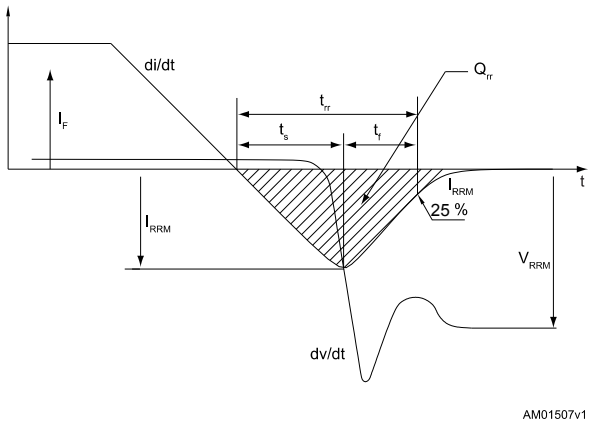


Figure 19. Gate charge test circuit

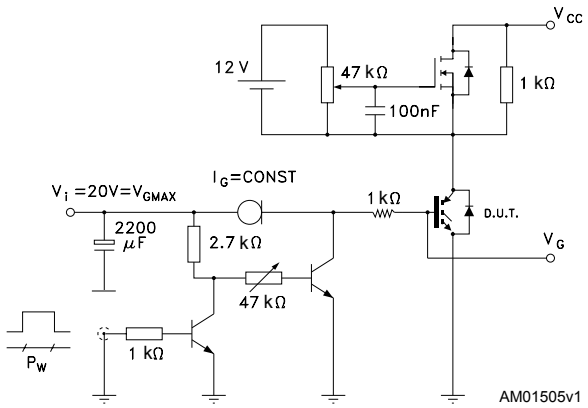
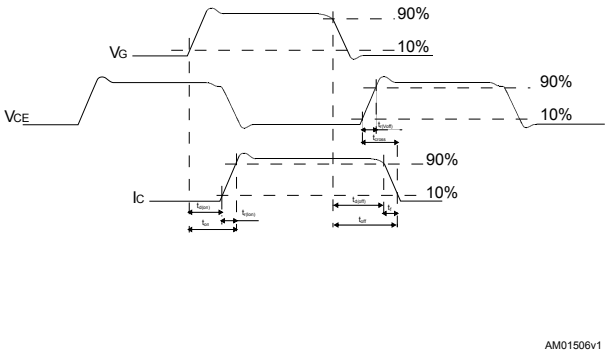


Figure 20. Switching waveform



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**

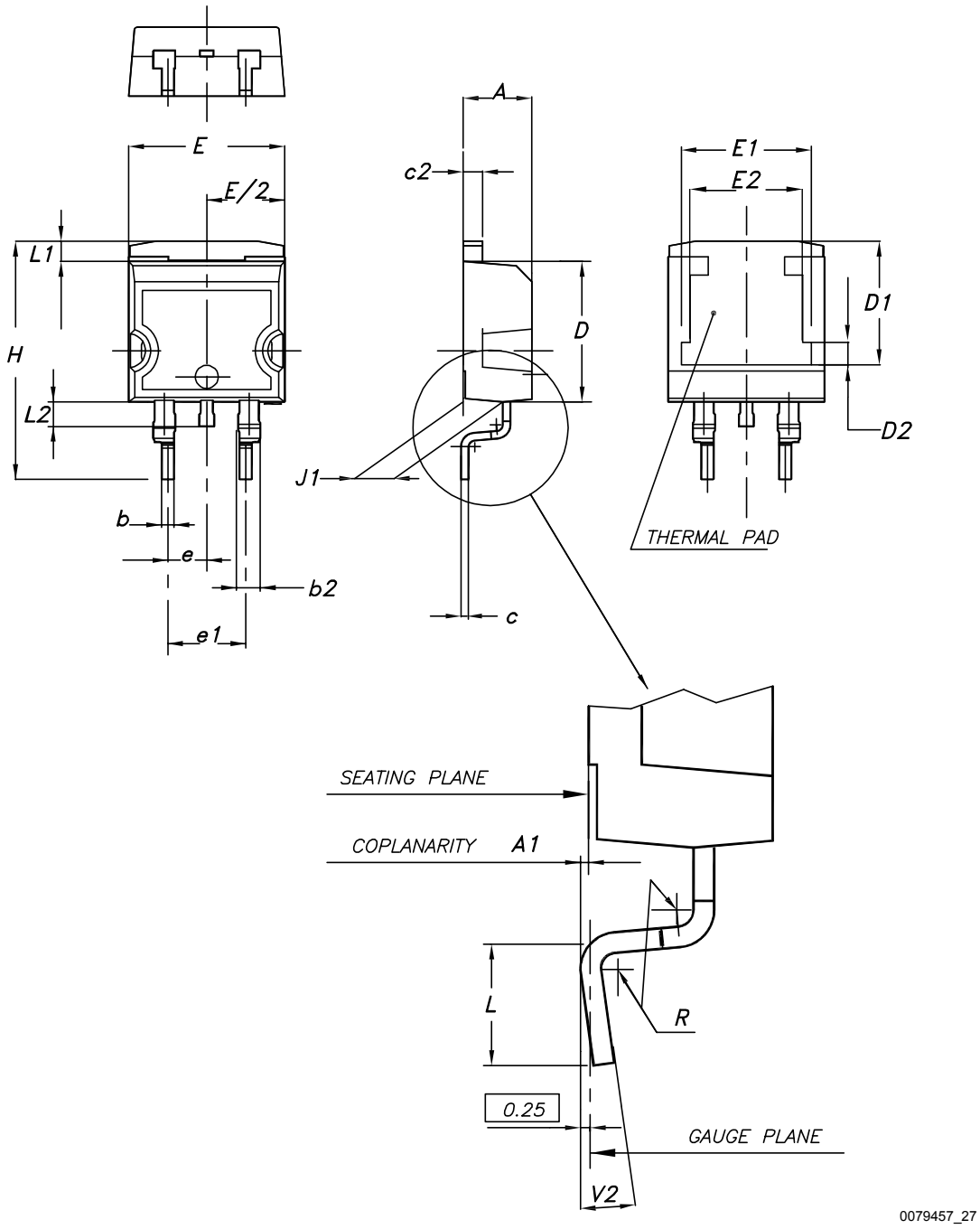
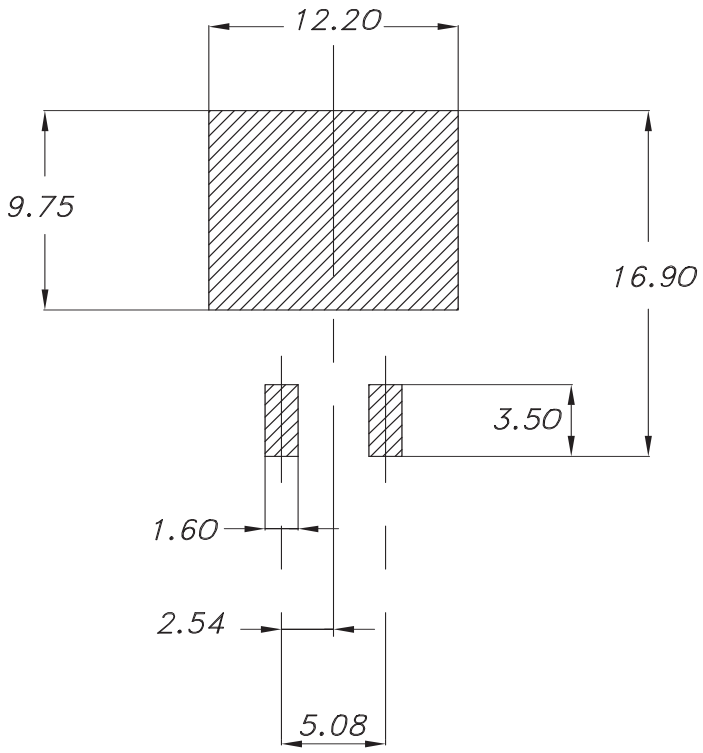


Table 8. D²PAK (TO-263) type A package mechanical data

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)**



4.2 TO-220 type A package information

Figure 23. **TO-220 type A package outline**

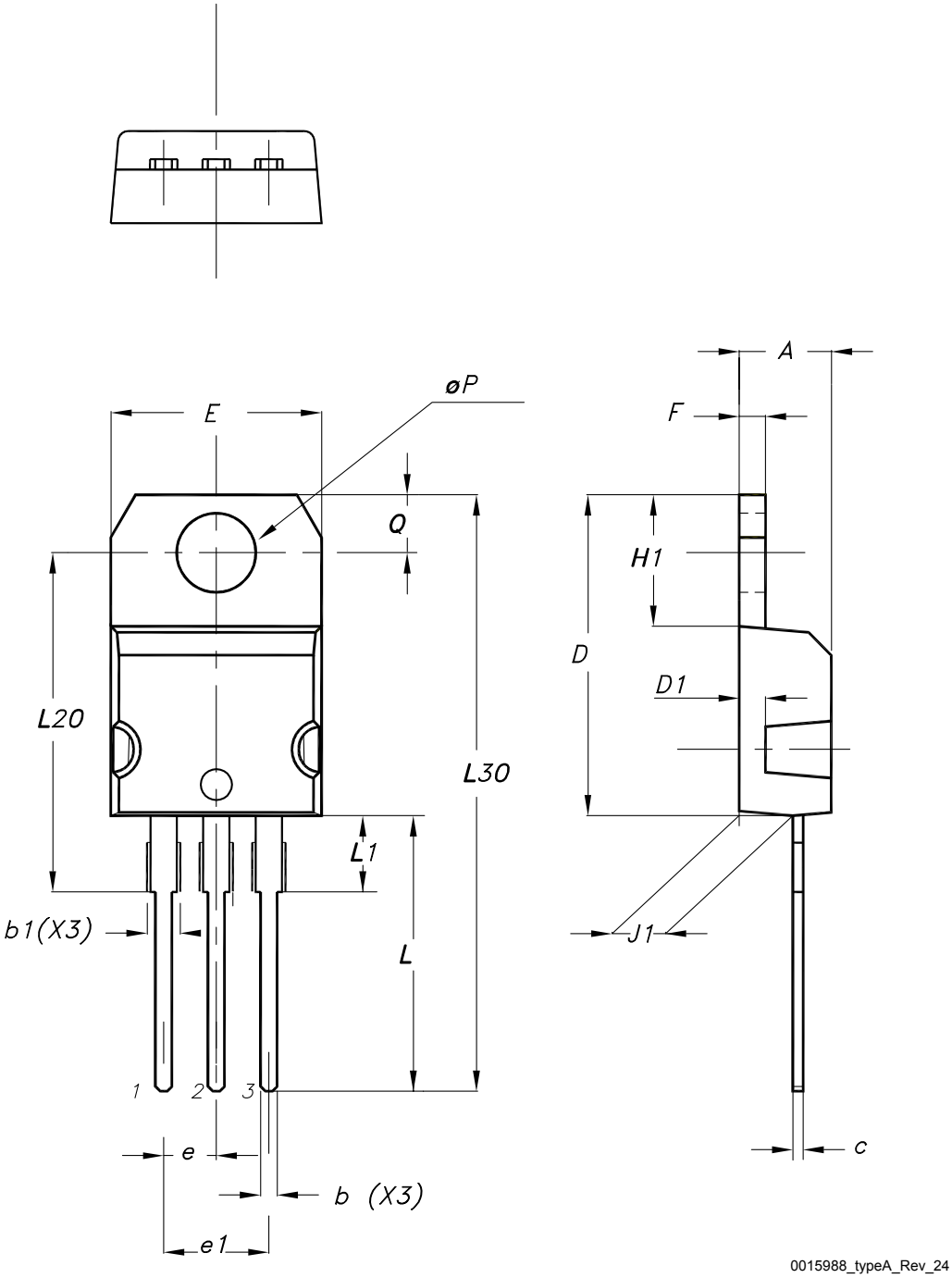
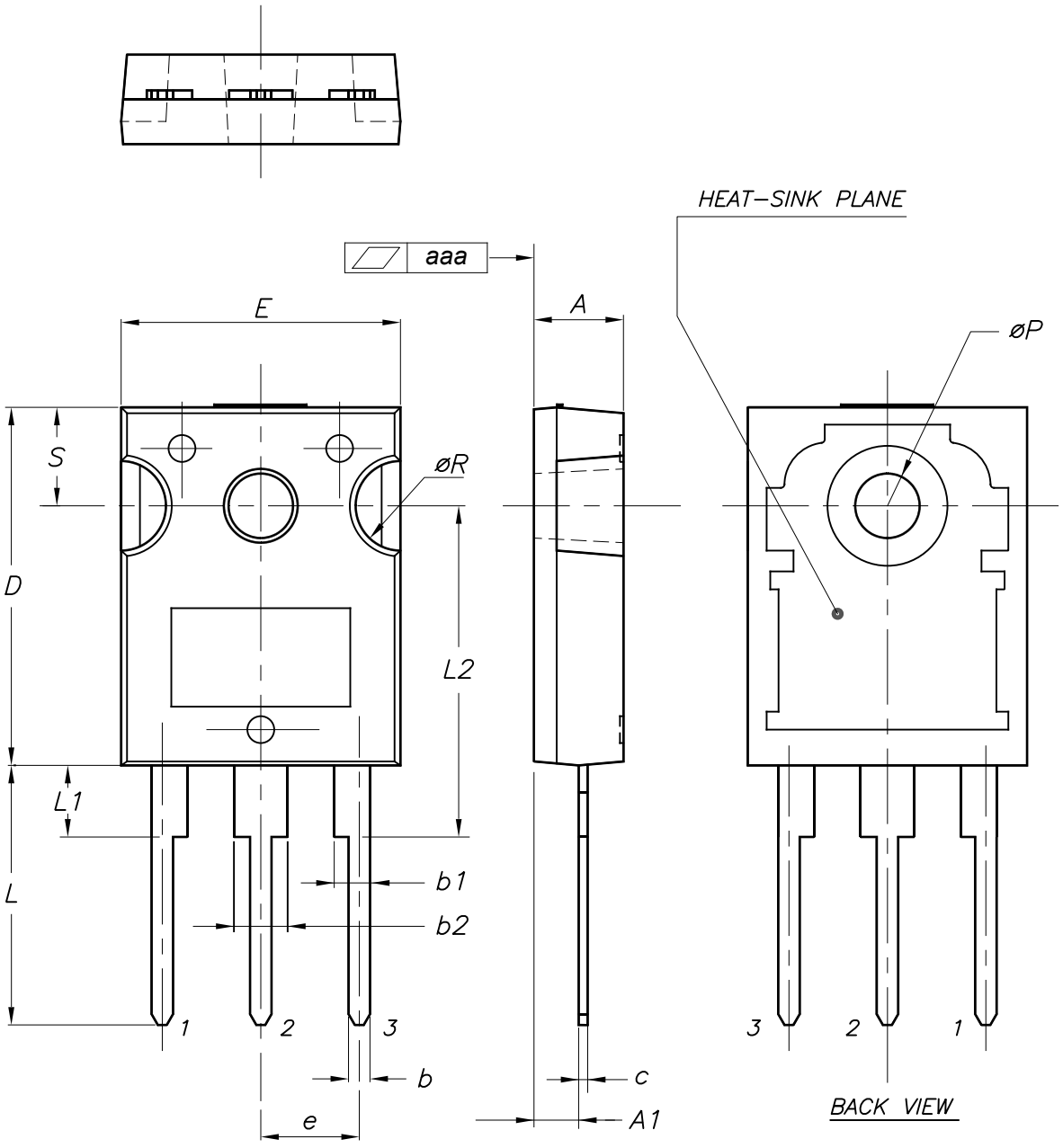


Table 9. **TO-220 type A package mechanical data**

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**



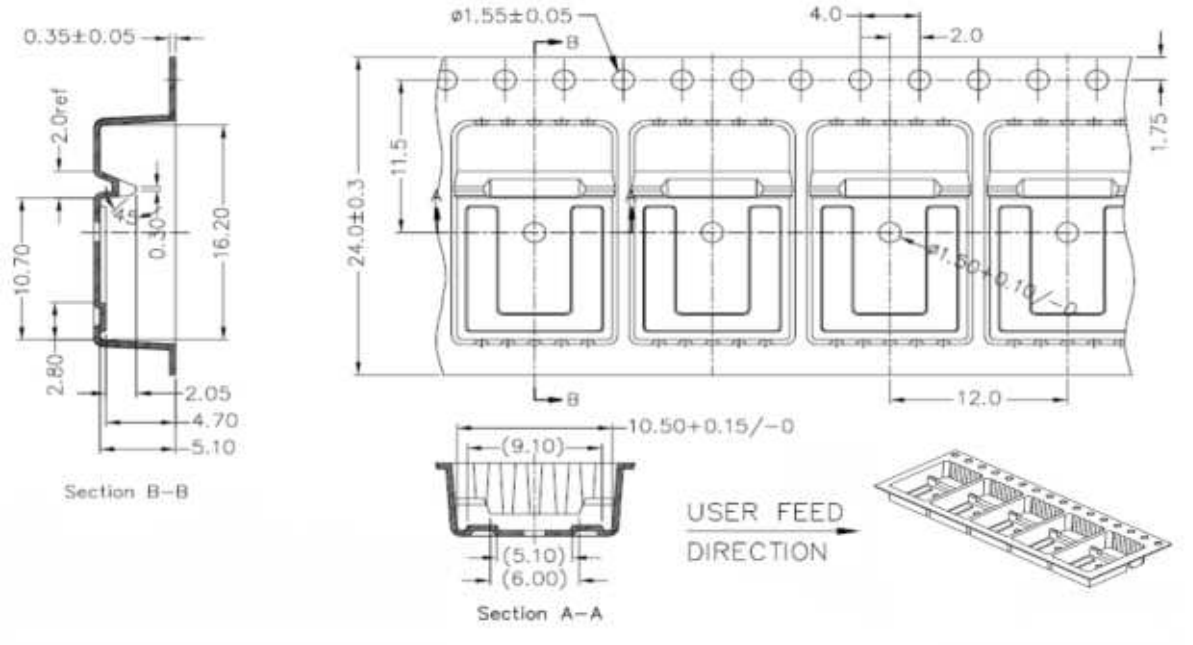
0075325_10

Table 10. **TO-247 package mechanical data**

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

4.4 D²PAK packing information

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



DM01095771_1

5 Ordering information

Table 11. **Order codes**

Order codes	Marking	Package	Packing
STGB19NC60HDT4	GB19NC60HD	D²PAK	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: *Table 2: Absolute maximum ratings*. Inserted new packages, mechanical data: TO-220FP, TO-247.
13-Oct-2008	4	V_{ISO} inserted in *Table 2* 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 *Table 4: Static*.
02-Sep-2011	9	Removed order code STGWA19NC60HD in TO-247 long leads package.
06-Sep-2016	10	Added *Section 5.2: TO-247 package information*. Minor text changes.
13-May-2025	11	Updated Section 4: Package information. Removed order code STGF19NC60HD in TO-2220FP.

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