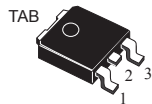
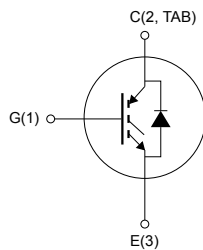


N-channel 600 V, 7 A very fast IGBT



DPAK



NG1E3C2T

Features

Order codes	V_{CES}	$V_{CE(sat)}$ max.	I_C (at $T_C = 100\text{ }^\circ\text{C}$)
STGD6NC60HDT4	600 V	2.5 V	7 A

- Low on-voltage drop ($V_{CE(sat)}$)
- Low CRES / CIES ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode
- High frequency operation

Applications

- High-frequency inverters
- SMPS and PFC in both hard switch and resonant topologies
- Motor drivers

Description

This device is a very fast IGBT developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. This device is well-suited for resonant or soft-switching applications.



Product status link

[STGD6NC60HDT4](#)

Product summary

Order code	STGD6NC60HDT4
Marking	GD6NC60HD
Package	DPAK
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$ V)	600	V
I_C	Continuous collector current at $T_C = 25$ °C	15	A
	Continuous collector current at $T_C = 100$ °C	7	A
$I_{CP}^{(1)}$	Pulsed collector current	21	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Diode RMS forward current at $T_C = 25$ °C	10	A
P_{TOT}	Total power dissipation at $T_C = 25$ °C	63	W
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		°C

1. Pulse width limited by maximum junction temperature.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case	2	°C/W
R_{thJA}	Thermal resistance junction-ambient	100	°C/W

2 Electrical characteristics

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

Table 3. Static characteristics

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	$V_{GE} = 15\text{ V}, I_C = 3\text{ A}$		1.9	2.5	V
		$V_{GE} = 15\text{ V}, I_C = 3\text{ A}, T_C = 125\text{ °C}$		1.7		
$V_{GE(th)}$	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	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$			10	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_C = 125\text{ °C}$ ⁽¹⁾			1	mA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			± 100	nA

1. Defined by design, not subject to production test.

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	205	-	pF
C_{oes}	Output capacitance		-	32	-	
C_{res}	Reverse transfer capacitance		-	5.5	-	
Q_g	Total gate charge	$V_{CC} = 390\text{ V}, I_C = 3\text{ A},$ $V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 17. Gate charge test circuit)	-	13.6	-	nC
Q_{ge}	Gate-emitter charge		-	3	-	
Q_{gc}	Gate-collector charge		-	6	-	
I_{CL}	Turn-off SOA minimum current	$V_{clamp} = 390\text{ V}, T_j = 150\text{ °C},$ $R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V}$	-	19	-	A

Table 5. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 390\text{ V}, I_C = 3\text{ A},$ $V_{GE} = 15\text{ V}, R_G = 10\text{ }\Omega$ (see Figure 16. Test circuit for inductive load switching)	-	12	-	ns
t_r	Current rise time		-	5	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	612	-	A/ μs
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 390\text{ V}, I_C = 3\text{ A},$ $V_{GE} = 15\text{ V}, R_G = 10\text{ }\Omega,$ $T_j = 125\text{ °C}$ (see Figure 16. Test circuit for inductive load switching)	-	13	-	ns
t_r	Current rise time		-	4.3	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	560	-	A/ μs

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off voltage rise time	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ (see Figure 16. Test circuit for inductive load switching)	-	40	-	ns
$t_{d(off)}$	Turn-off delay time		-	76	-	ns
t_f	Current fall time		-	100	-	ns
$t_{r(Voff)}$	Off voltage rise time	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching)	-	60	-	ns
$t_{d(off)}$	Turn-off delay time		-	98	-	ns
t_f	Current fall time		-	124	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ (see Figure 16. Test circuit for inductive load switching)	-	20	-	μJ
$E_{off}^{(2)}$	Turn-off switching energy		-	68	-	μJ
E_{ts}	Total switching energy		-	88	-	μJ
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching)	-	37	-	μJ
$E_{off}^{(2)}$	Turn-off switching energy		-	93	-	μJ
E_{ts}	Total switching energy		-	130	-	μJ

1. Including the reverse recovery of the diode
2. Including the tail of the collector current

Table 7. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 1.5\text{ A}$	-	1.6	2.1	V
		$I_F = 1.5\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$	-	1.3		
t_{rr}	Reverse recovery time	$I_F = 3\text{ A}$, $V_R = 40\text{ V}$,	-	21		ns
Q_{rr}	Reverse recovery charge	$di_F/dt = 100\text{ A}/\mu\text{s}$ (see Figure 19. Diode reverse recovery waveform)	-	14		nC
I_{rrm}	Reverse recovery current		-	1.36		A
t_{rr}	Reverse recovery time	$I_F = 3\text{ A}$, $V_R = 40\text{ V}$,	-	34		ns
Q_{rr}	Reverse recovery charge	$di_F/dt = 100\text{ A}/\mu\text{s}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 19. Diode reverse recovery waveform)	-	32		nC
I_{rrm}	Reverse recovery current		-	1.88		A

2.1 Electrical characteristics (curves)

Figure 1. Switching energy vs gate resistance

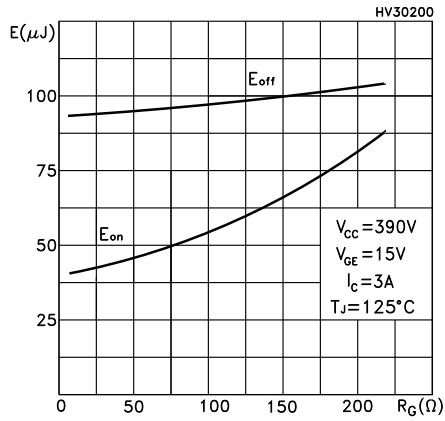


Figure 2. Switching energy vs collector current

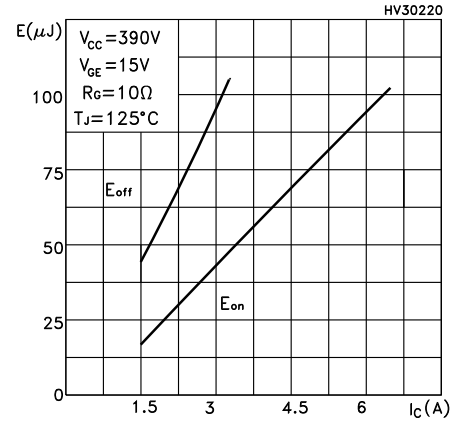


Figure 3. Normalized breakdown voltage vs temperature

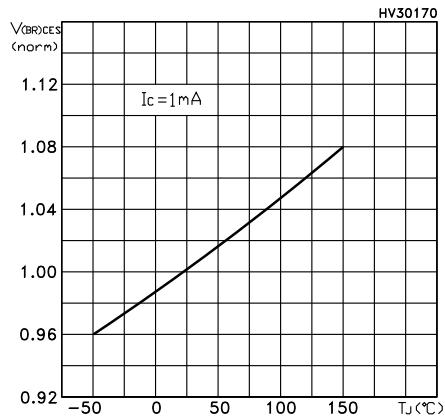


Figure 4. Switching energy vs temperature

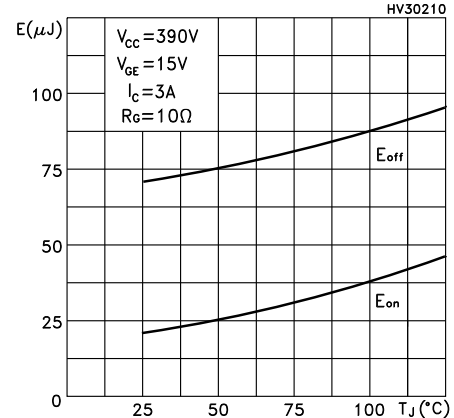


Figure 5. Normalized gate threshold voltage vs temperature

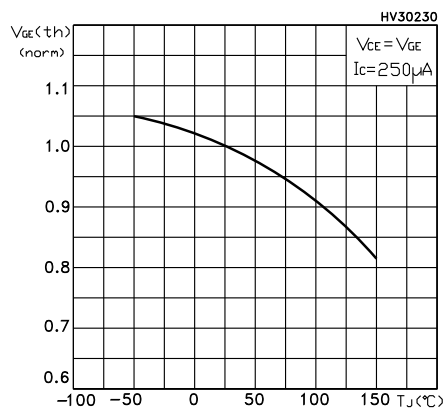


Figure 6. Collector-emitter on voltage vs collector current

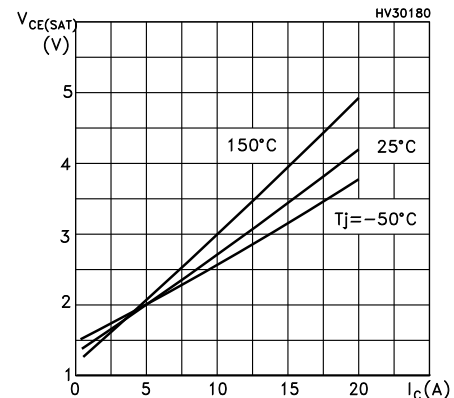


Figure 7. Gate charge vs gate-source voltage

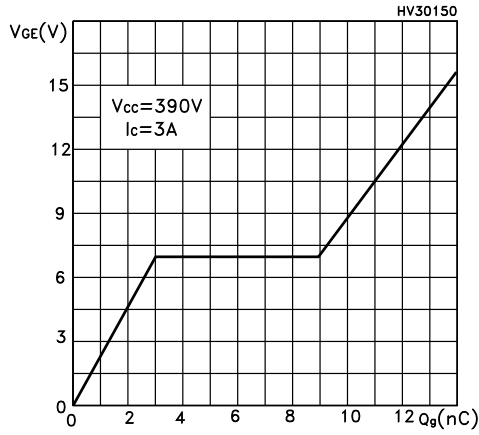


Figure 8. Capacitance variations

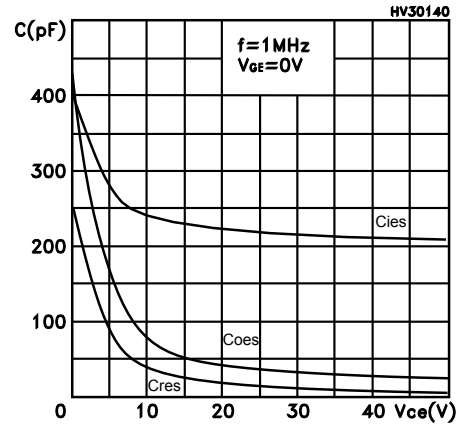


Figure 9. Transconductance

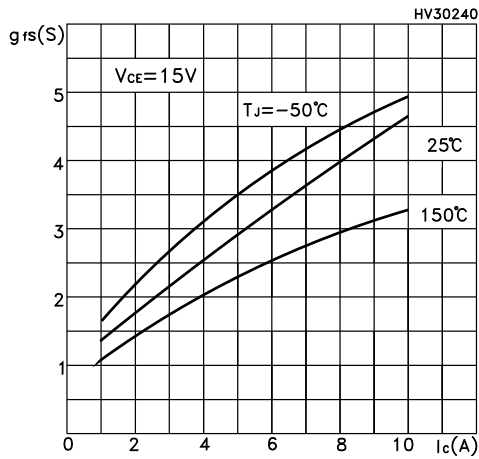


Figure 10. Collector-emitter on-voltage vs temperature

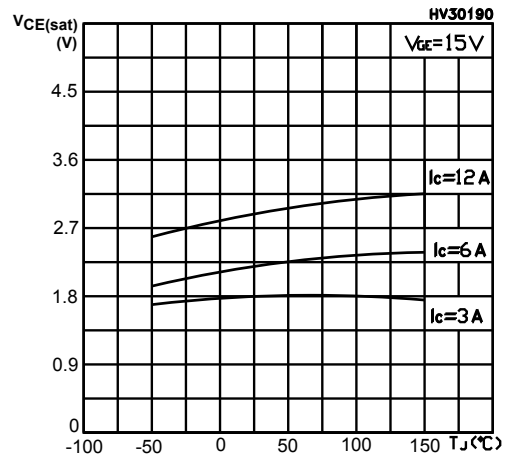


Figure 11. Output characteristics

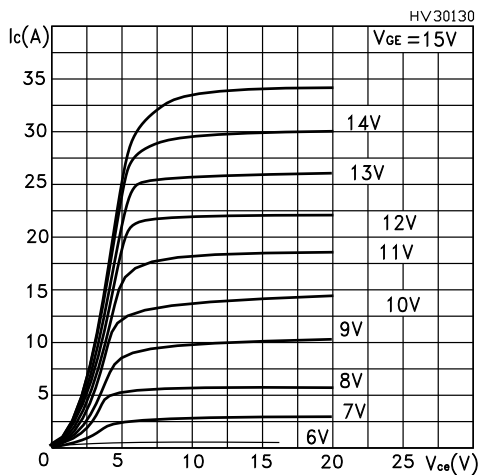


Figure 12. Transfer characteristics

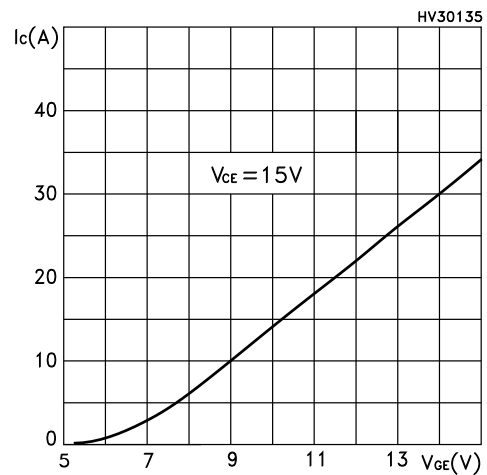


Figure 13. Thermal impedance

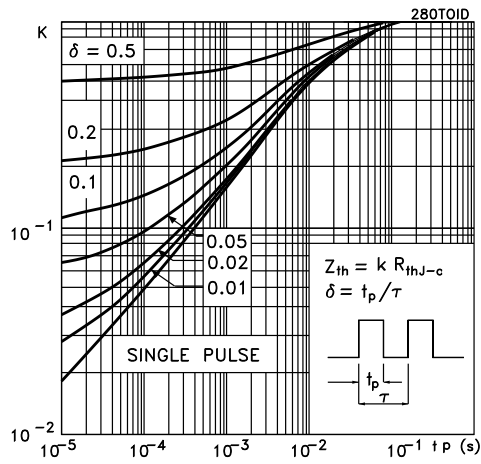


Figure 14. Turn-off SOA

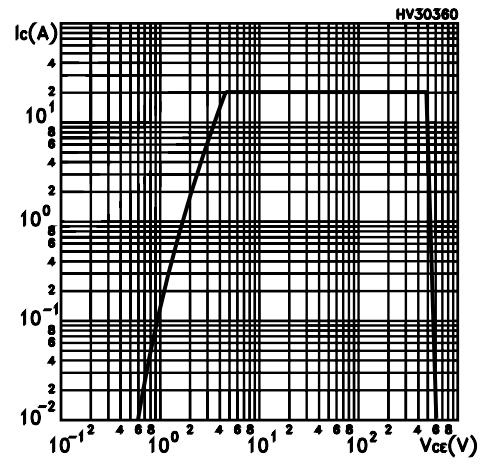
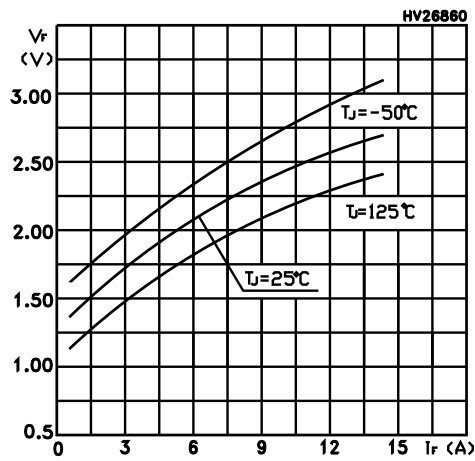
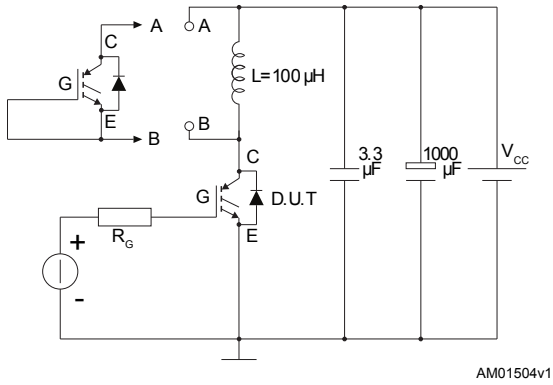
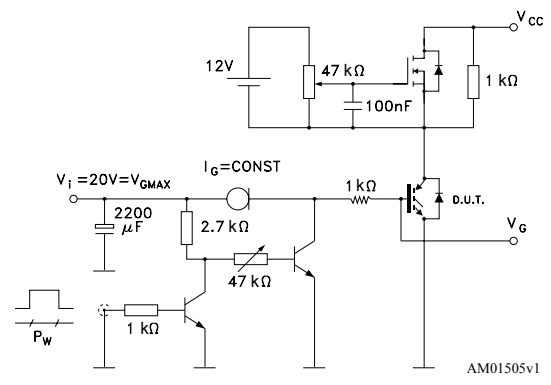
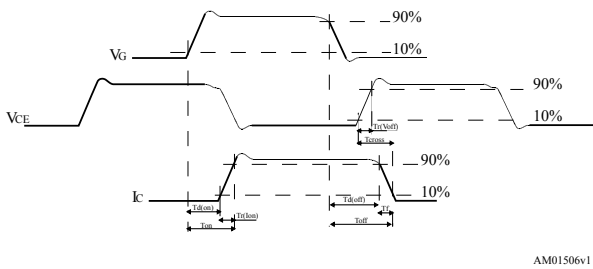
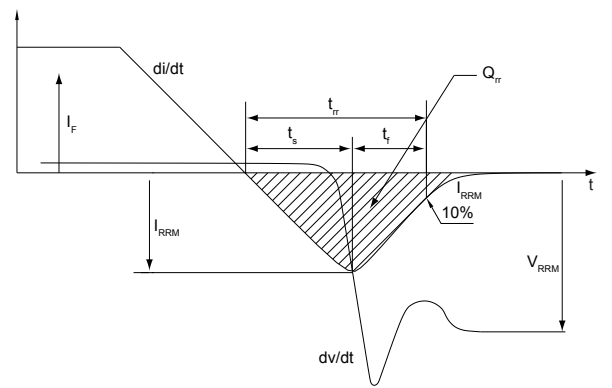


Figure 15. Emitter-collector diode characteristics



3 Test circuits

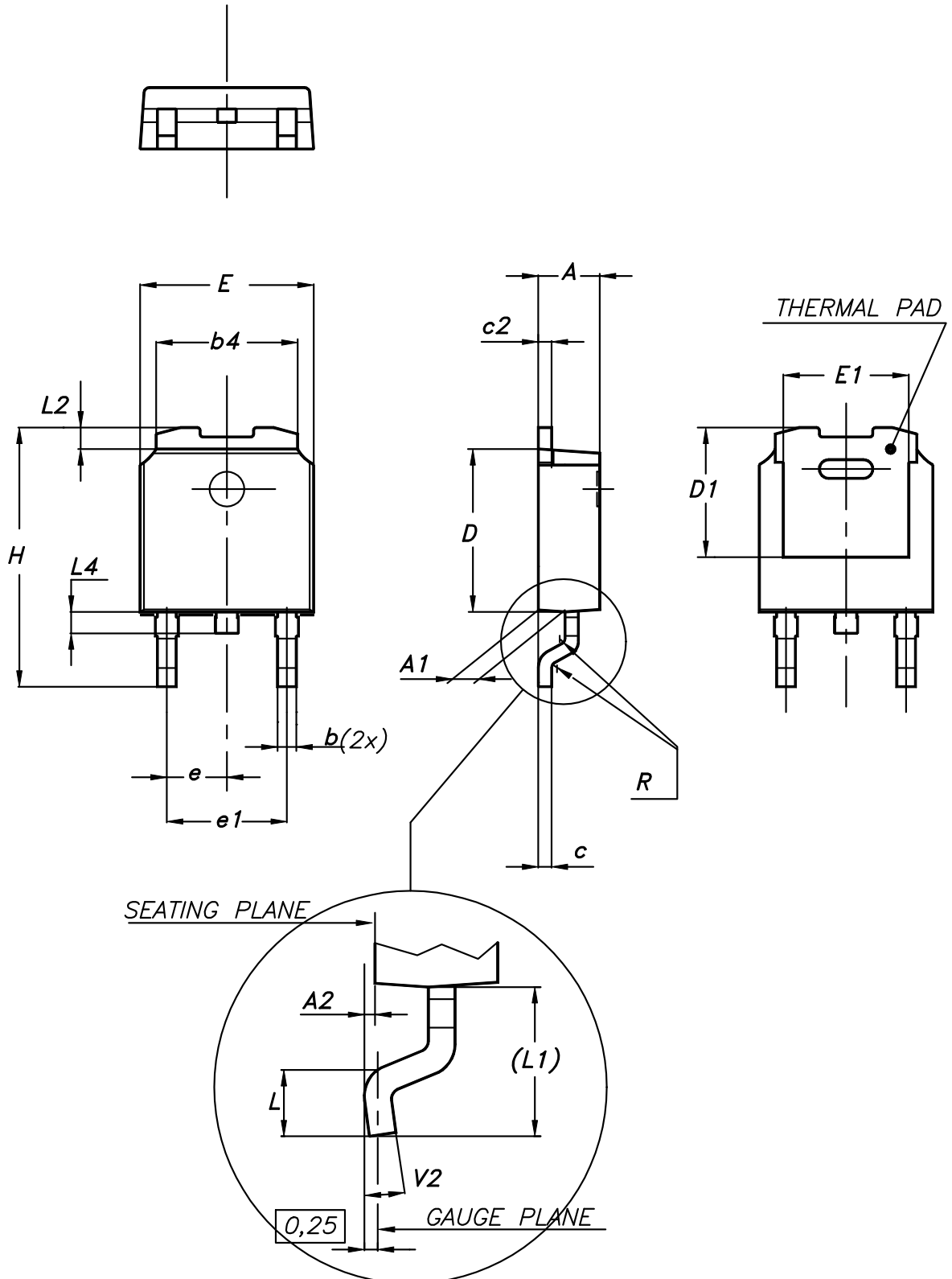
Figure 16. Test circuit for inductive load switching

Figure 17. Gate charge test circuit

Figure 18. Switching waveform

Figure 19. Diode reverse recovery waveform


4 Package information

In order 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 DPAK (TO-252) type A2 package information

Figure 20. DPAK (TO-252) type A2 package outline



0068772_type-A2_rev26

Table 8. DPAK (TO-252) type A2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	5.10	5.20	5.30
e	2.159	2.286	2.413
e1	4.445	4.572	4.699
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

4.2 DPAK (TO-252) type C2 package information

Figure 21. DPAK (TO-252) type C2 package outline

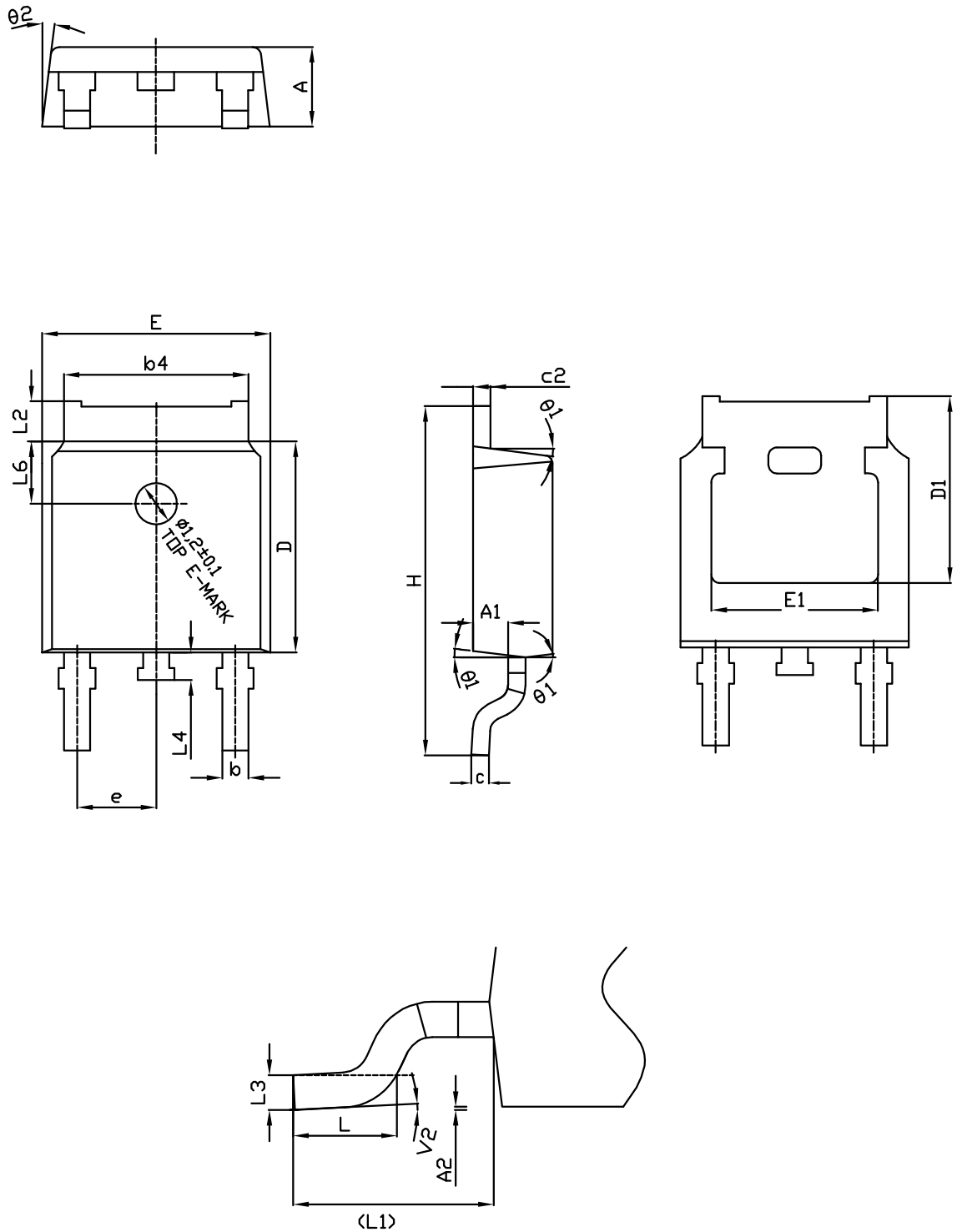
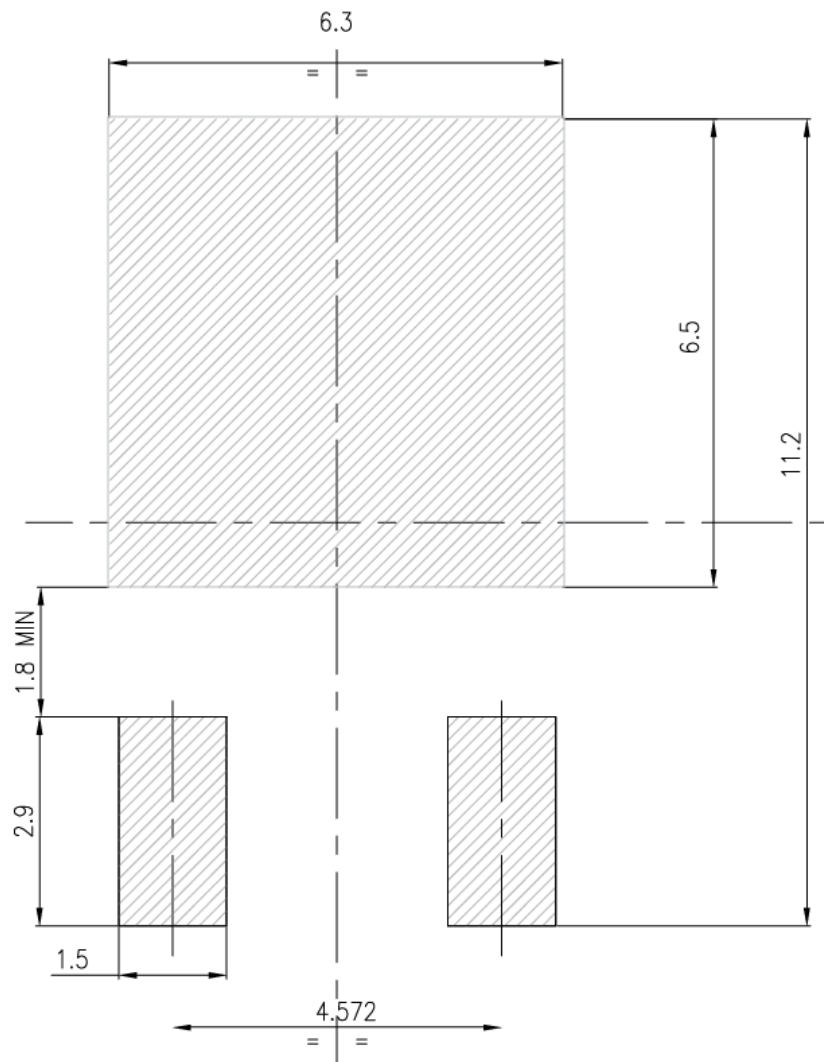


Table 9. DPAK (TO-252) type C2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.90	1.01	1.10
A2	0.00		0.10
b	0.72		0.85
b4	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.10		5.60
E	6.50	6.60	6.70
E1	5.20		5.50
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.90		1.25
L3	0.51 BSC		
L4	0.60	0.80	1.00
L6	1.80 BSC		
θ1	5°	7°	9°
θ2	5°	7°	9°
V2	0°		8°

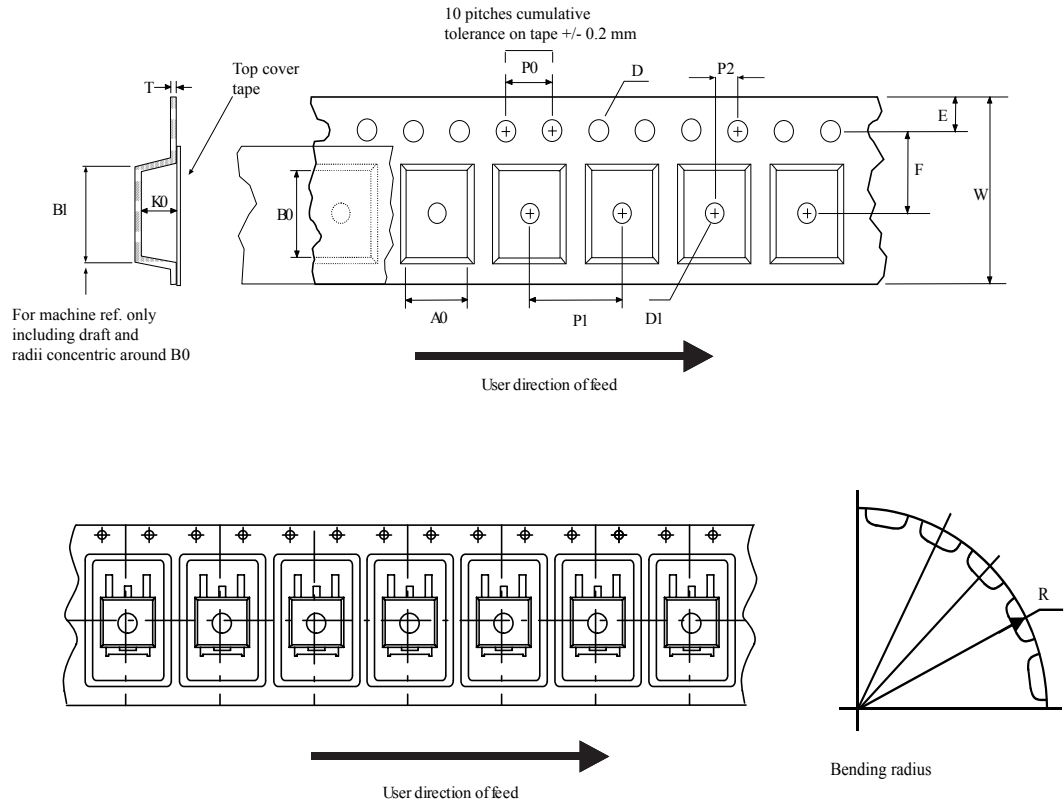
Figure 22. DPAK (TO-252) recommended footprint (dimensions are in mm)



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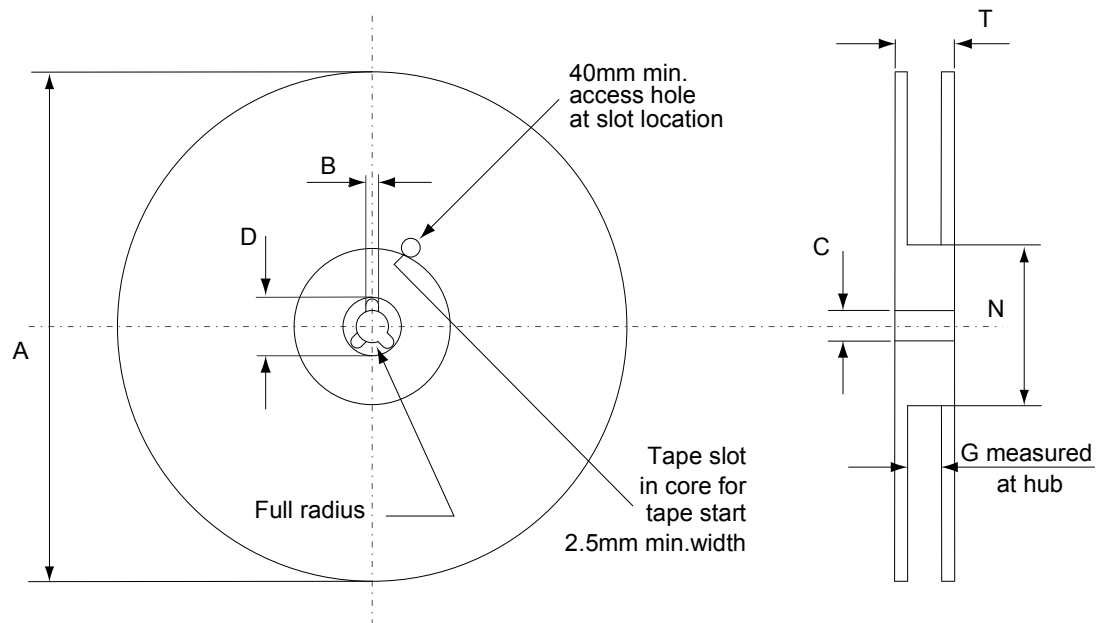
4.3 DPAK (TO-252) packing information

Figure 23. DPAK (TO-252) tape outline



AM08852v1

Figure 24. DPAK (TO-252) reel outline



AM06038v1

Table 10. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1		Base qty.	2500
P1	7.9	8.1		Bulk qty.	2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Revision history

Table 11. Document revision history

Date	Revision	Changes
01-Oct-2018	1	First release.
04-Dec-2018	2	Added Section 4.1 DPAK (TO-252) type A2 package information and Section 4.2 DPAK (TO-252) type C2 package information.

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