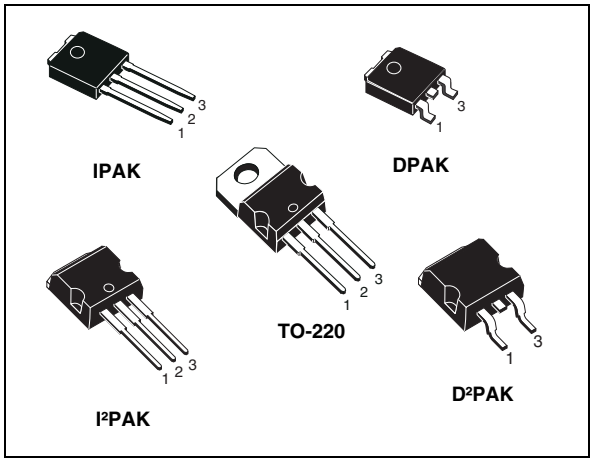
STGB18N40LZ
STGD18N40LZ, STGP18N40LZ

EAS 180 mJ - 390 V - internally clamped IGBT

Features

- AEC Q101 compliant
- 180 mJ of avalanche energy @ T_C = 150 °C, L = 3 mH
- ESD gate-emitter protection
- Gate-collector high voltage clamping
- Logic level gate drive
- Low saturation voltage
- High pulsed current capability
- Gate and gate-emitter resistor



Application

- Pencil coil electronic ignition driver

Description

This application-specific IGBT utilizes the most advanced PowerMESH™ technology. The built-in Zener diodes between gate-collector and gate-emitter provide overvoltage protection capabilities. The device also exhibits low on-state voltage drop and low threshold drive for use in automotive ignition system.

Figure 1. Internal schematic diagram

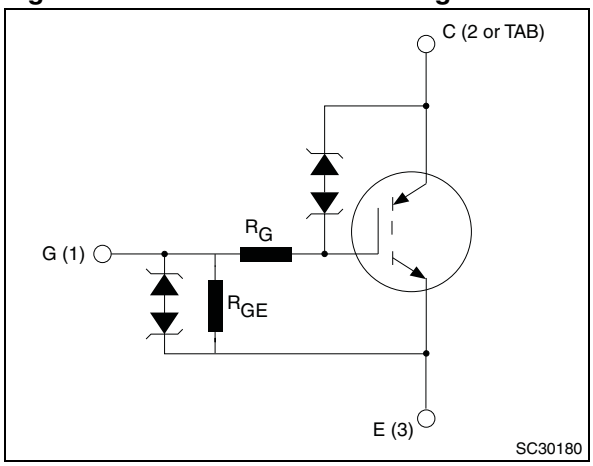


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB18N40LZ-1	GB18N40LZ	I²PAK	Tube
STGB18N40LZT4	GB18N40LZ	D²PAK	Tape and reel
STGD18N40LZ-1	GD18N40LZ	IPAK	Tube
STGD18N40LZT4	GD18N40LZ	DPAK	Tape and reel
STGP18N40LZ	GP18N40LZ	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		DPAK IPAK	D²PAK I²PAK, TO-220	
V_{CES}	Collector-emitter voltage (v_{GE} = 0)	$V_{CES(clamped)}$		V
V_{ECS}	Emitter collector voltage (V_{GE} = 0)	20		V
I_C (1)	Collector current (continuous) at T_C = 100 °C	25	30	A
I_{CP} (2)	Pulsed collector current	40		A
V_{GE}	Gate-emitter voltage	$V_{GE(clamped)}$		V
P_{TOT}	Total dissipation at T_C = 25 °C	125	150	W
E_{AS}	Single pulse energy T_C= 25 °C, L = 3 mH, V_{CC} = 50 V	300		mJ
E_{AS}	Single pulse energy T_C=150 °C, L = 3 mH, V_{CC} = 50 V	180		mJ
ESD	Human body model, R= 1.5 kΩ, C = 100 pF	8		kV
	Machine model, R = 0, C = 100 pF	800		V
	Charged device model	2		kV
T_{stg}	Storage temperature	– 55 to 175		°C
T_j	Operating junction temperature			

1. Calculated according to the iterative formula

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2. Pulse width limited by max. junction temperature allowed

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		DPAK IPAK	D²PAK I²PAK, TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.2	1	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	100	62.5	°C/W

2 Electrical characteristics

(T_J=25 °C unless otherwise specified)

Table 4. Static electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(clamped)}$	Collector emitter clamped voltage (V_{GE} = 0)	I_C = 2 mA T_J = - 40 °C to 150 °C	360	390	420	V
$V_{(BR)ECS}$	Emitter collector break-down voltage (V_{GE} = 0)	I_C = 75 mA	20	28		V
$V_{GE(clamped)}$	Gate emitter clamped voltage	I_G = ±2 mA	12		16	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 15 V, T_J = 150 °C			10	µA
		V_{CE} = 200 V, T_J = 150 °C			100	µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ±10 V	450	625	830	µA
R_{GE}	Gate emitter resistance		12	16	22	kΩ
R_G	Gate resistance			1.6		kΩ
$V_{GE(th)}$	Gate threshold voltage	V_{GE} =V_{CE}, I_C = 1 mA, T_J = -40 °C	1.4			V
		V_{GE} =V_{CE}, I_C = 1 mA	1.2	1.6	2.3	V
		V_{GE} =V_{CE}, I_C = 1 mA, T_J =150 °C	0.7			V
$V_{CE(sat)}$	Collector emitter saturation voltage	V_{GE} = 4.5 V, I_C = 10 A		1.35	1.7	V
		V_{GE} = 4.5 V, I_C = 10 A, T_J = 150 °C		1.30		V
		V_{GE} = 3.8 V, I_C = 6 A		1.30		V

Table 5. Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0	-	490	-	pF
C_{oes}	Output capacitance		-	90	-	pF
C_{res}	Reverse transfer capacitance		-	5	-	pF
Q_g	Gate charge	V_{CE} = 280 V, I_C = 10 A, V_{GE} = 5 V	-	29	-	nC

Table 6. Switching on/off

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
	Resistive load					
$t_{d(on)}$	Turn-on delay time	V_{CC} = 14 V,	-	0.65	-	µs
t_r	Rise time	R_L = 1 Ω, V_{GE} = 5 V		3.5		µs
	Resistive load					
$t_{d(on)}$	Turn-on delay time	V_{CC} = 14 V,	-	0.65	-	µs
t_r	Rise time	R_L = 1 Ω, V_{GE} = 5 V, T_J = 150 °C		3.8		µs
	Inductive load					
$t_{d(off)}$	Turn-off delay time	V_{CC} = 300 V, L = 1 mH	-	13.5	-	µs
t_f	Fall time	I_C = 10 A, V_{GE} = 5 V		5.5		µs
dv/dt	Turn-off voltage slope			105		V/µs
	Inductive load					
$t_{d(off)}$	Turn-off delay time	V_{CC} = 300 V, L = 1 mH	-	14.2	-	µs
t_f	Fall time	I_C = 10 A, V_{GE} = 5 V		8		µs
dv/dt	Turn-off voltage slope	T_J = 150 °C		97		V/µs

2.1 Electrical characteristics (curves)

Figure 2. Collector-emitter on voltage vs temperature

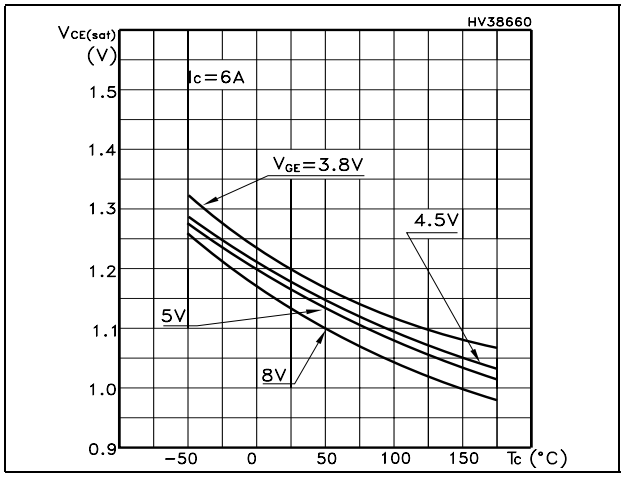


Figure 3. Collector-emitter on voltage vs temperature

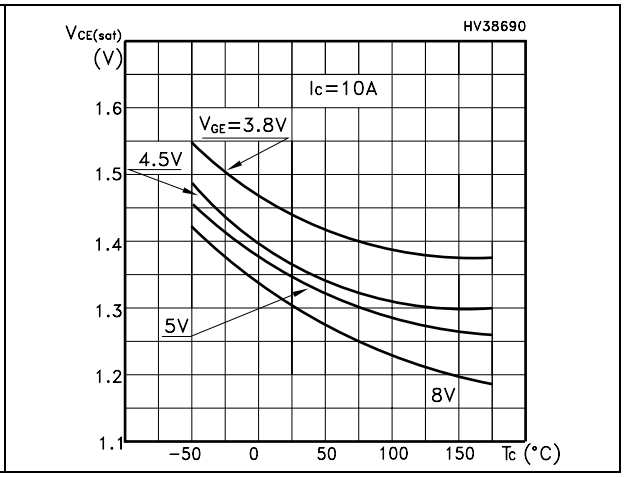


Figure 4. Collector-emitter on voltage vs temperature

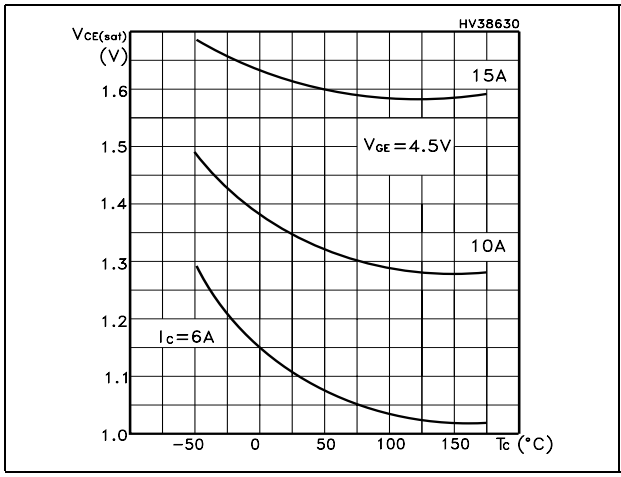


Figure 5. Self clamped inductive switch

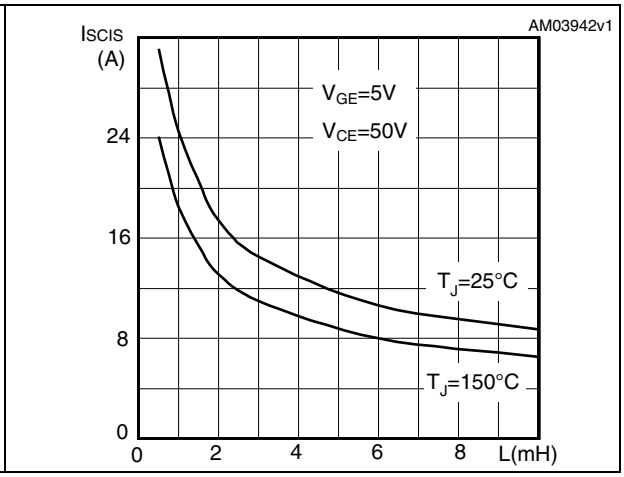


Figure 6. Output characteristics @ 25 °C

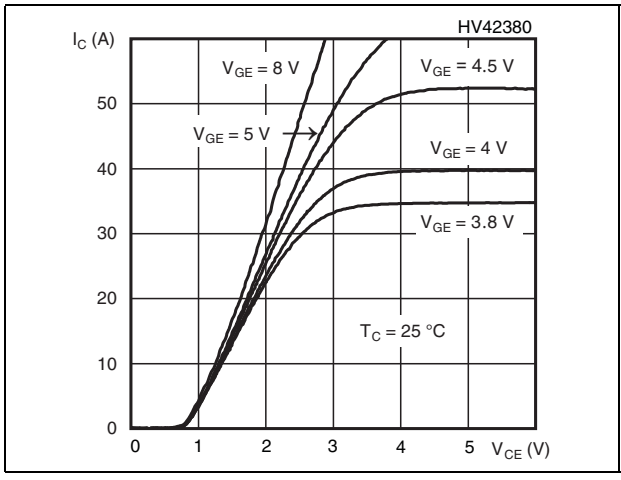


Figure 7. Output characteristics @ -40 °C

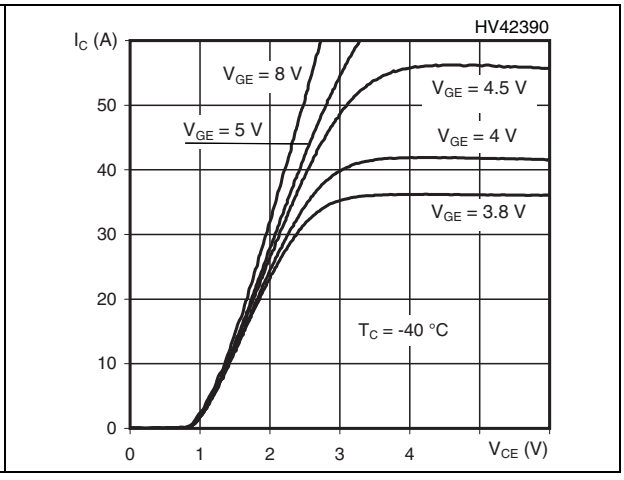


Figure 8. Output characteristics @ 175 °C

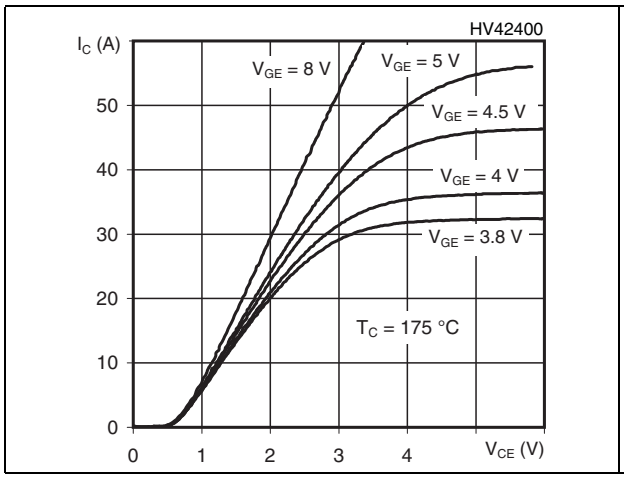


Figure 9. Transfer characteristics

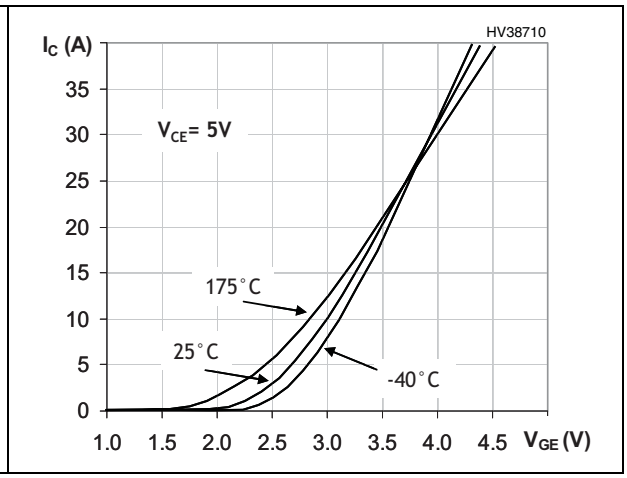


Figure 10. Collector cut-off current vs. temperature

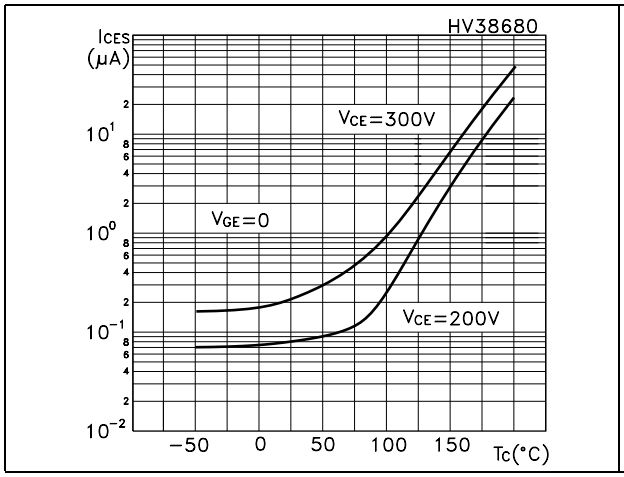


Figure 11. Normalized collector emitter voltage vs temperature

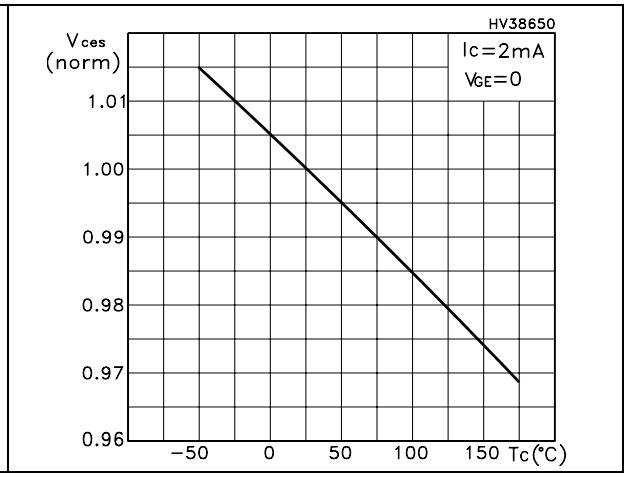


Figure 12. Normalized gate threshold voltage vs temperature

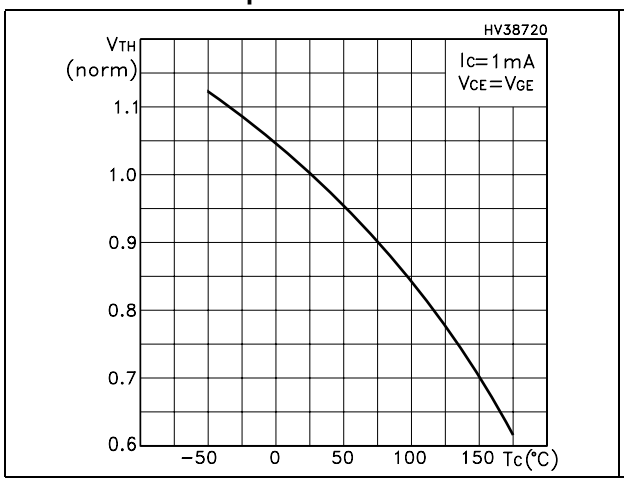


Figure 13. Normalized collector emitter on voltage vs temperature

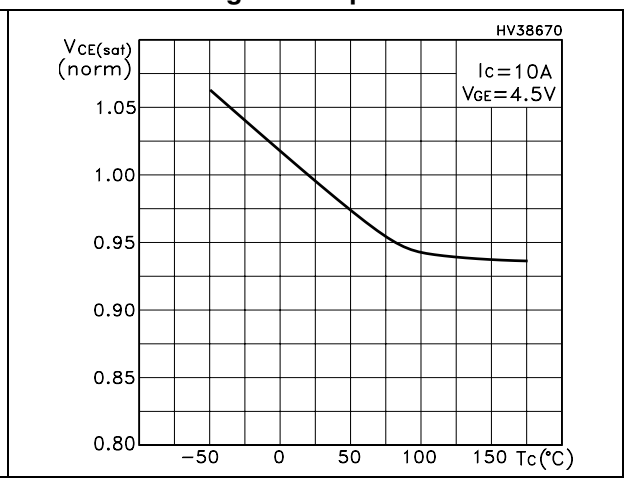


Figure 14. Thermal impedance for D²PAK, I²PAK, TO-220

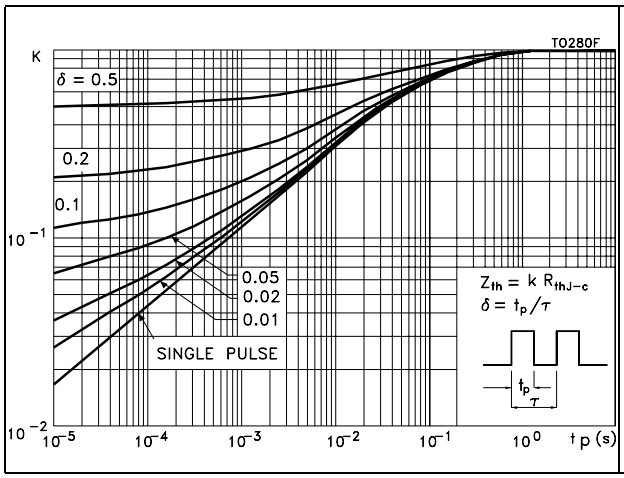
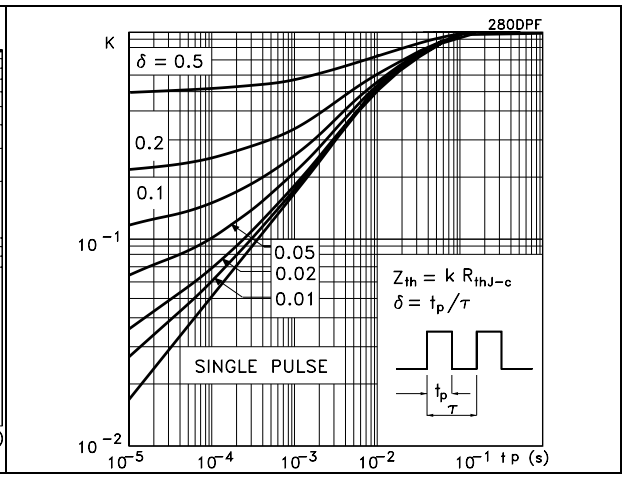


Figure 15. Thermal impedance for DPAK, IPAK



3 Test circuits

Figure 16. Inductive load switching

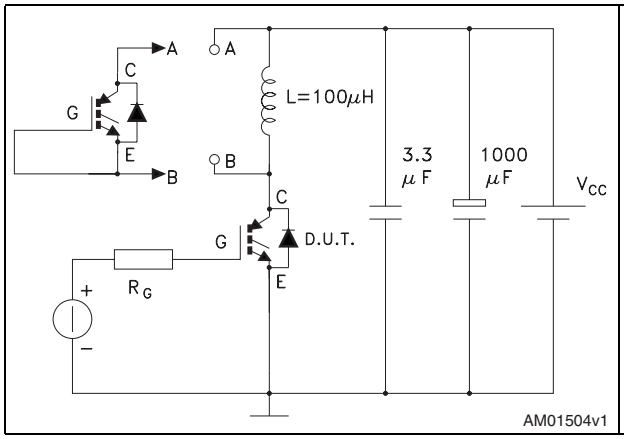


Figure 17. Resistive load switching

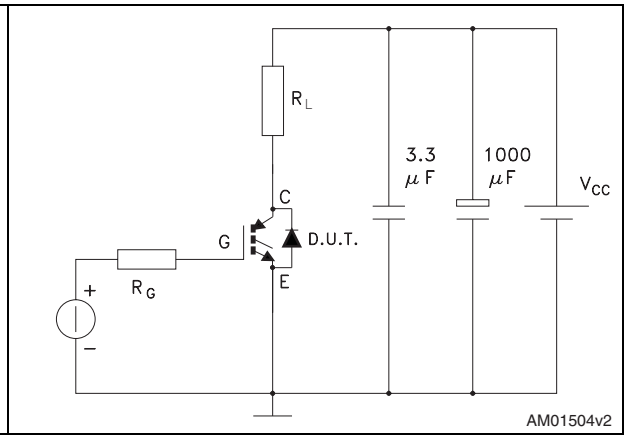


Figure 18. Gate charge test circuit

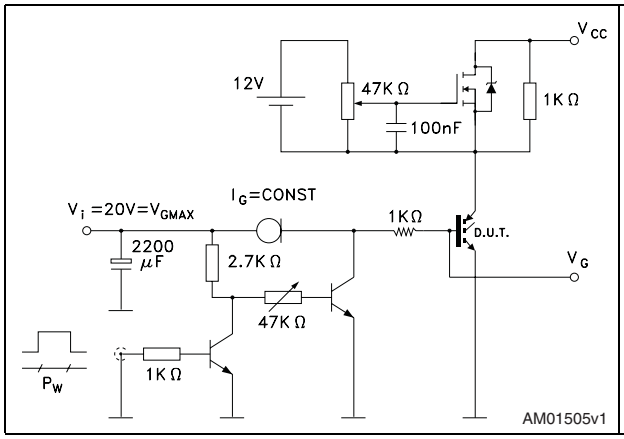
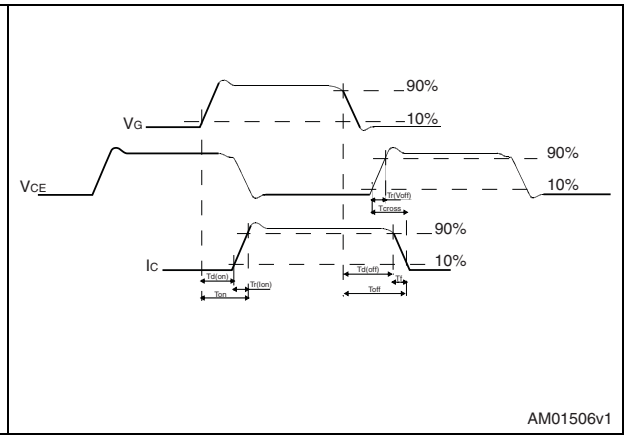


Figure 19. Switching waveform

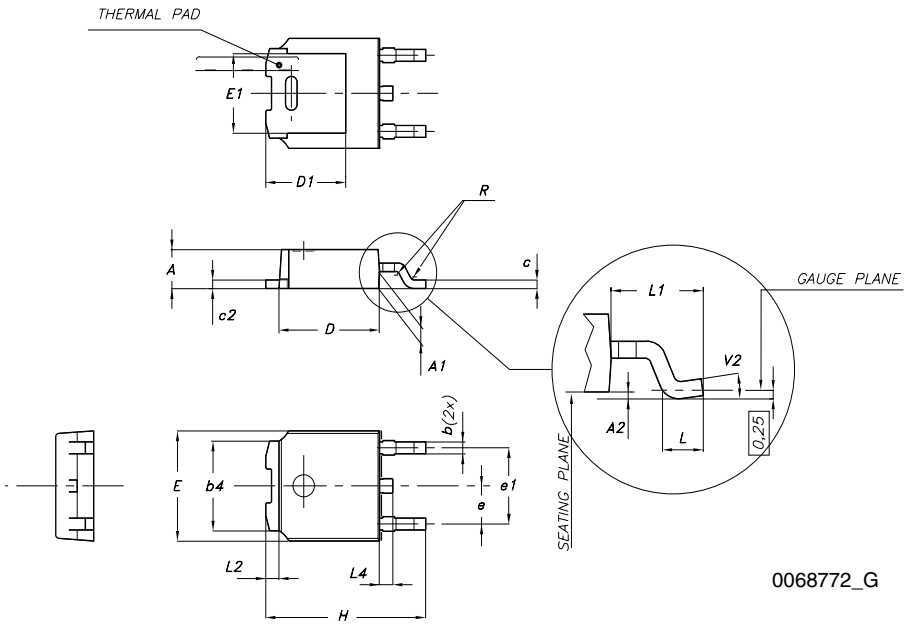


4 Package mechanical data

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.

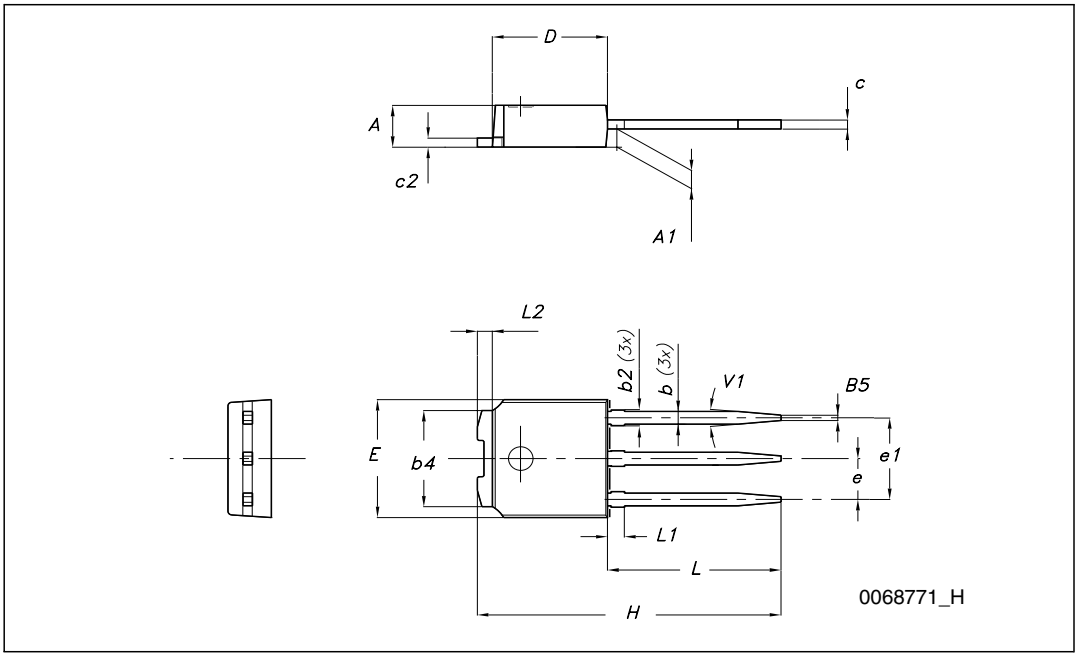
TO-252 (DPAK) mechanical data

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		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °



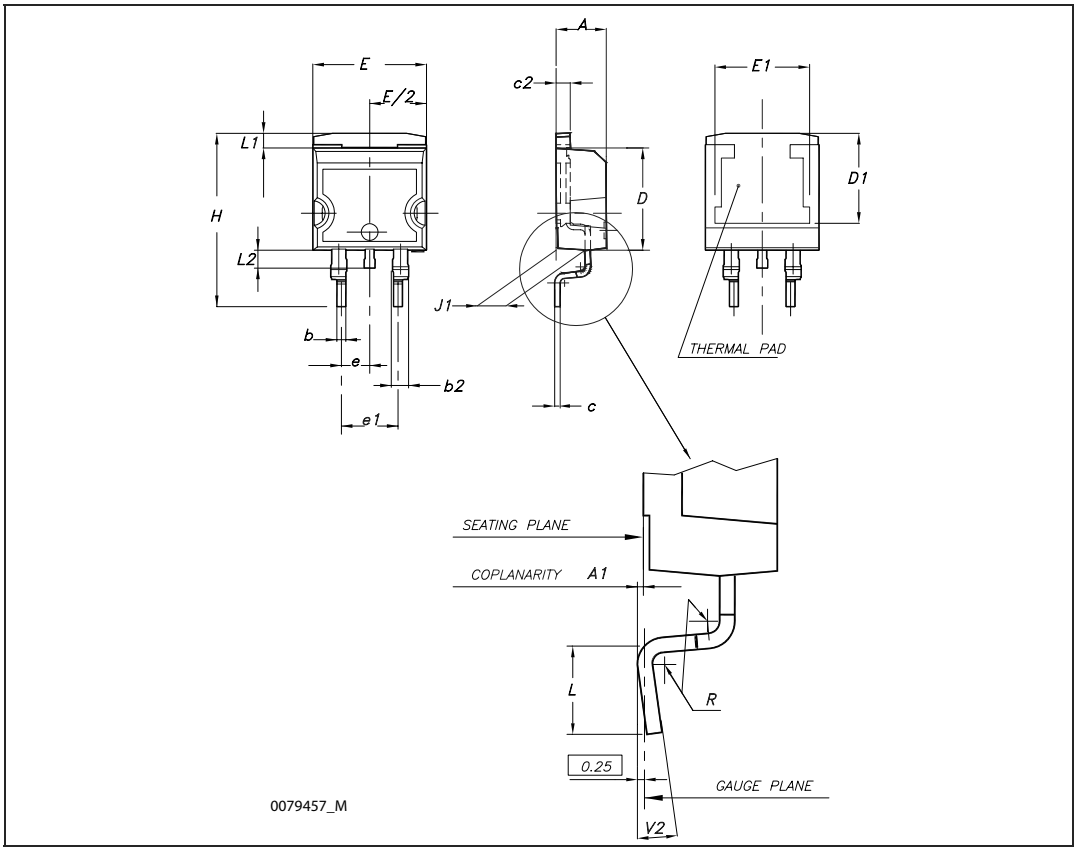
TO-251 (IPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10 °	



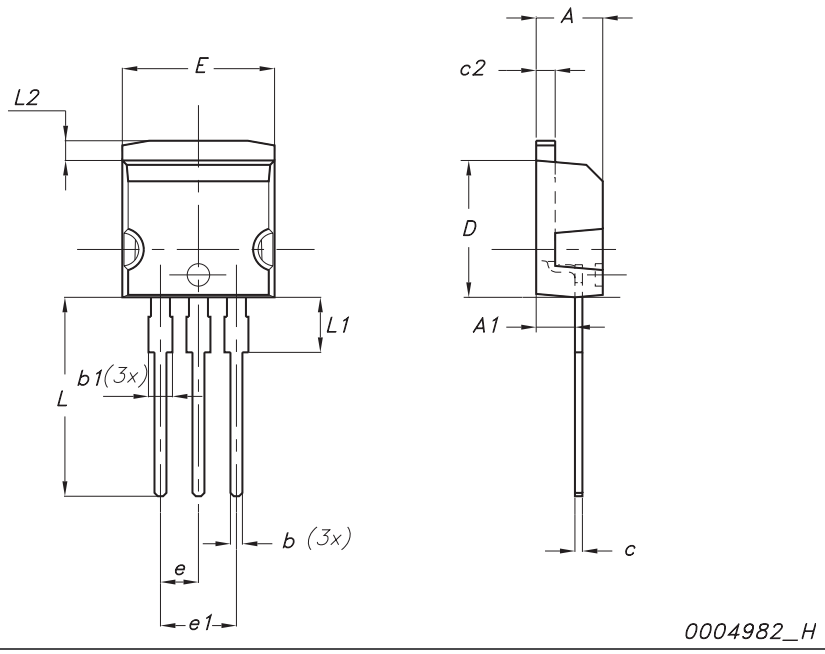
D²PAK (TO-263) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°



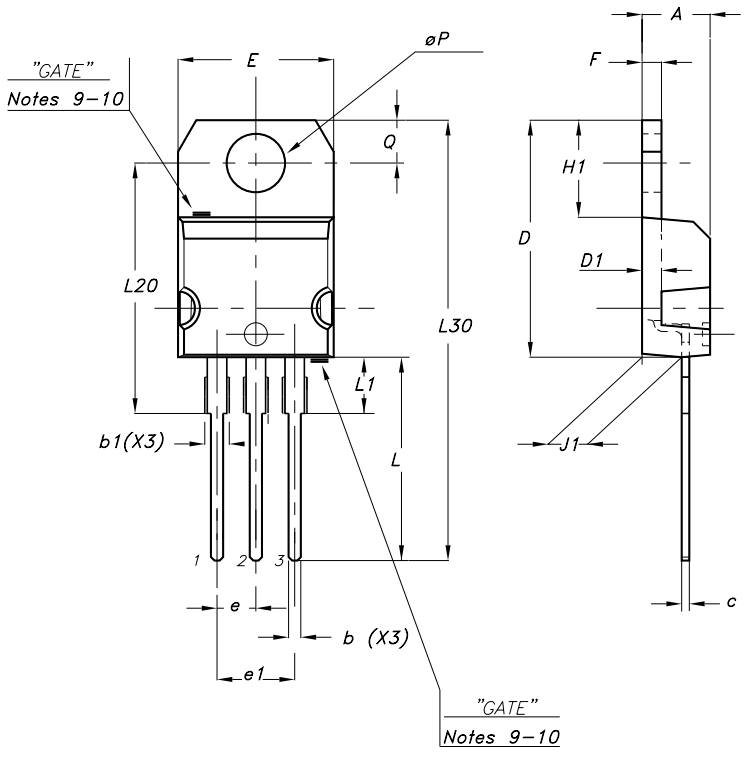
I²PAK (TO-262) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



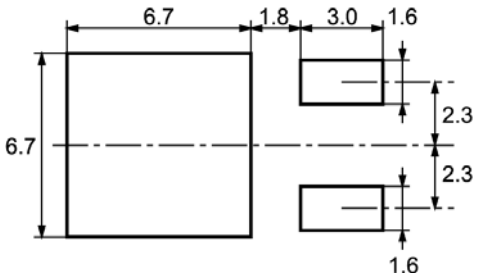
TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



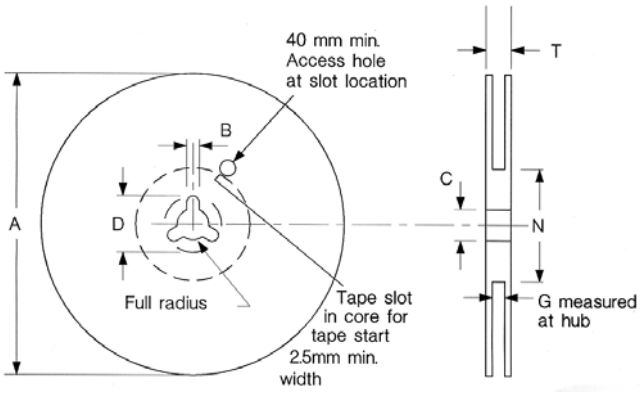
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



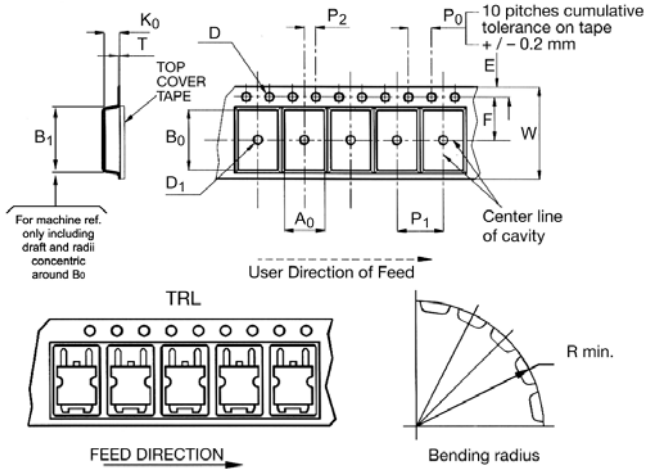
REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

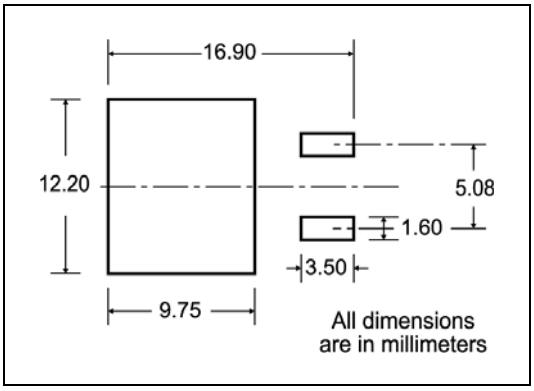
BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

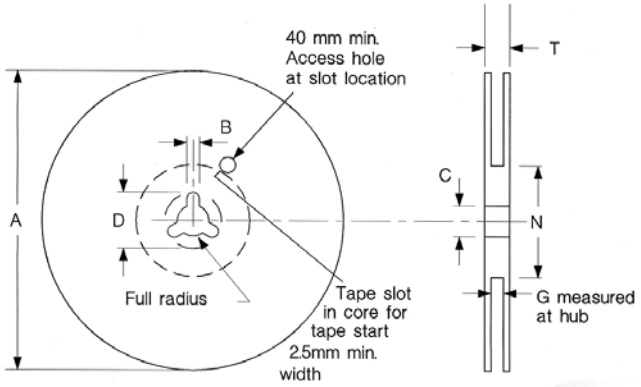
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641



D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



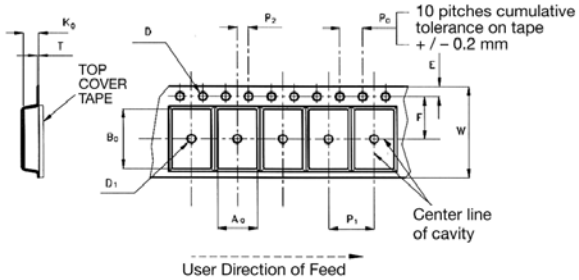
REEL MECHANICAL DATA

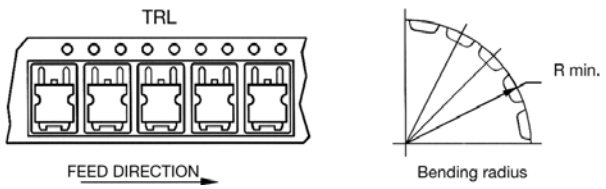
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956





* on sales type

6 Revision history

Table 7. Document revision history

Date	Revision	Changes
18-Jan-2008	1	Initial release.
07-Mar-2008	2	Modified *Figure 7*, *Figure 8*, *Figure 10*.
07-May-2008	3	Modified *Figure 9*
31-Mar-2009	4	Added new package, mechanical data: TO-220
18-May-2009	5	Modified *Figure 5*

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