STGB35N35LZ
STGP35N35LZ

Automotive-grade 345 V internally clamped IGBT, E_{AS} 450 mJ

Datasheet - production data

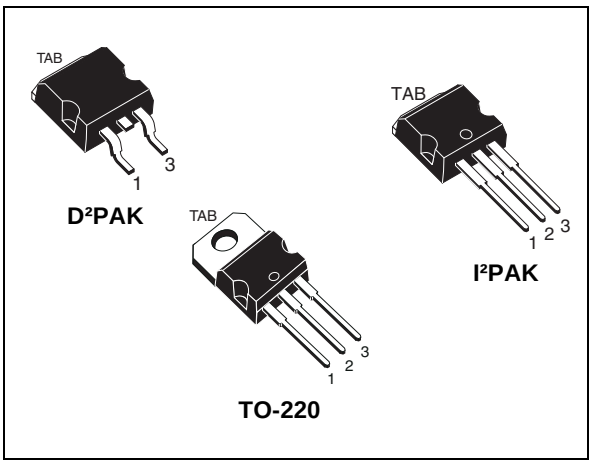
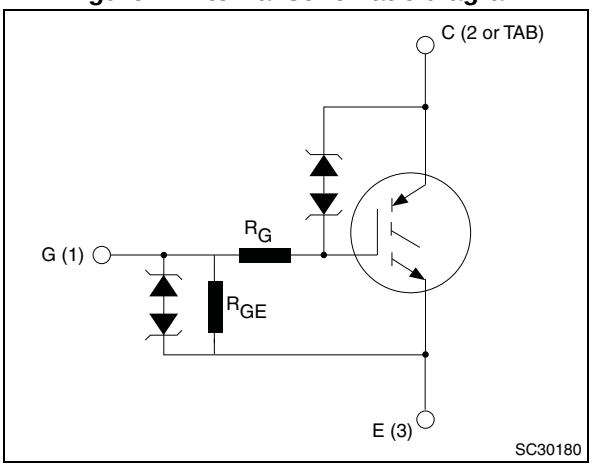


Figure 1. Internal schematic diagram



Features

- Designed for automotive applications and AEC-Q101 qualified
- Low threshold voltage
- Low on-voltage drop
- High voltage clamping feature
- Logic level gate charge
- ESD gate-emitter protection
- Gate and gate-emitter integrated resistors

Application

- Automotive ignition

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.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB35N35LZ-1	GB35N35LZ	I²PAK	Tube
STGB35N35LZT4	GB35N35LZ	D²PAK	Tape and reel
STGP35N35LZ	GP35N35LZ	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
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)	Continuous collector current at T_C = 25 °C	40	A
I_C (1)	Continuous collector current at T_C = 100 °C	30	A
I_{CP} (2)	Pulsed collector current	80	A
V_{GE}	Gate-emitter voltage	$V_{GE\ (clamped)}$	V
P_{TOT}	Total dissipation at T_C = 25 °C	176	W
E_{AS}	Single pulse energy (T_C=25 °C, L=1.6 mH, I_C = 22 A, V_{CC} = 50 V)	450	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 maximum junction temperature

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.85	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/W

2 Electrical characteristics

(T_j =25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(clamped)}$	Collector emitter clamped voltage (V_{GE}=0)	I_C=2 mA,		345		V
		I_C=2 mA, T_j= - 40 °C to 150 °C	320		380	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	14	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	500	625	830	µA
R_{GE}	Gate emitter resistance		12	15	20	kΩ
R_G	Gate resistance			1.5		kΩ
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA, T_j=-40 °C	1.4			V
		V_{CE} =V_{GE}, I_C = 1 mA	1.2	1.6	2.3	V
		V_{CE} =V_{GE}, 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		1.15	1.5	V
		V_{GE} =4.5 V, I_C = 15 A		1.3	1.7	V

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25V, f = 1MHz, V_{GE} = 0	-	700	-	pF
C_{oes}	Output capacitance		-	150	-	pF
C_{res}	Reverse transfer capacitance		-	6	-	pF
Q_g	Gate charge	V_{CE} = 280V, I_C = 15A, V_{GE} = 5V	-	49	-	nC

Table 6. Functional characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
U.I.S.	Functional test open secondary coil	R_G = 0, T_j = 150 °C, V_{CC} = 50 V, V_{GE} = 5 V, L=1.6 mH	18	-	-	A

Table 7. Switching time

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Resistive load Turn-on delay time Rise time	V_{CC} = 14 V, R_L = 1 Ω, V_{GE} = 5 V	-	1.1 7	-	µs µs µs
$t_{d(on)}$ t_r	Resistive load Turn-on delay time Rise time	V_{CC} = 14 V, R_L = 1 Ω, V_{GE} = 5 V T_j = 150 °C	-	1 6.6	-	µs µs µs
$t_{d(off)}$ t_f dv/dt	Inductive load Turn-off delay time Fall time Turn-off voltage slope	V_{CC} = 300 V, L = 1 mH I_C = 15 A, V_{GE} = 5 V	-	26.5 5.5 70	-	µs µs V/µs
$t_{d(off)}$ t_f dv/dt	Inductive load Turn-off delay time Fall time Turn-off voltage slope	V_{CC} = 300 V, L = 1 mH I_C = 15 A, V_{GE} = 5 V T_j = 150 °C	-	28 9 65	-	µs µs V/µs

2.1 Electrical characteristics (curves)

Figure 2. Collector-emitter saturation voltage vs temperature

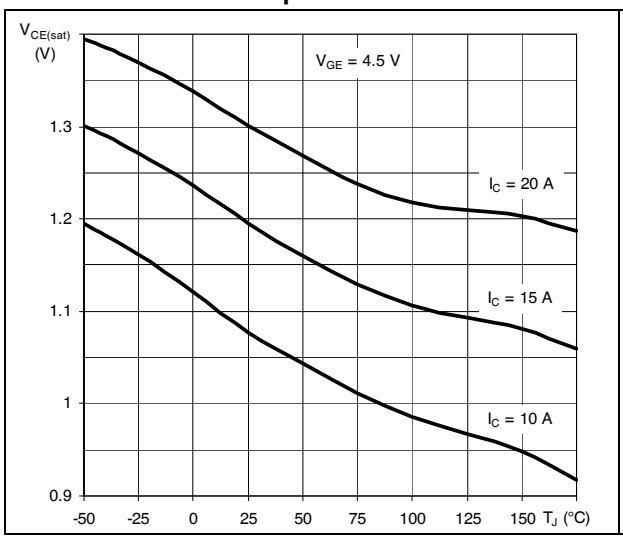


Figure 3. Self clamped inductive switch

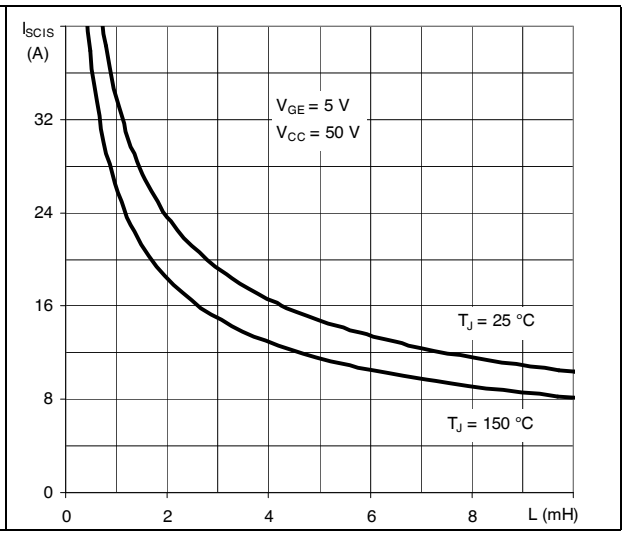


Figure 4. Output characteristics (T_J = 25 °C)

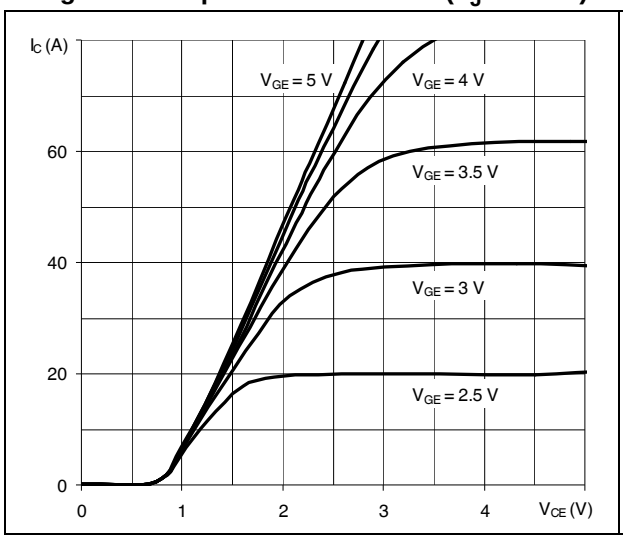


Figure 5. Output characteristics (T_J = -40 °C)

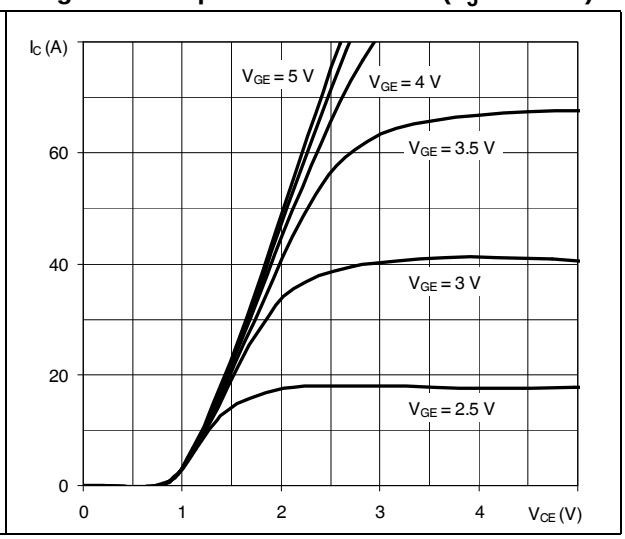


Figure 6. Output characteristics (T_J = 175 °C)

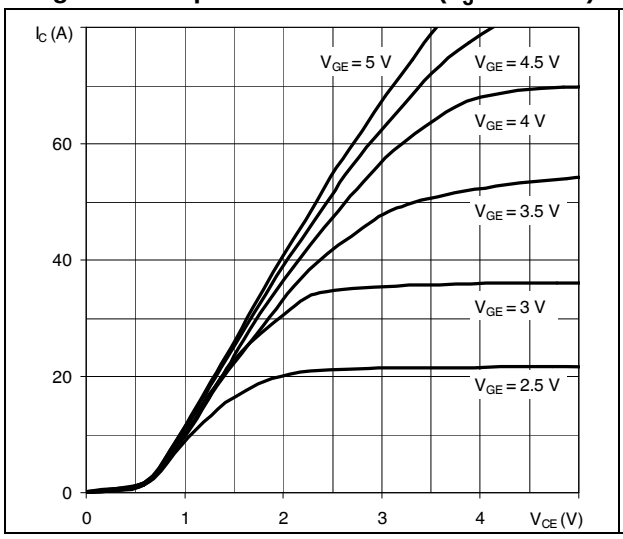


Figure 7. Transfer characteristics

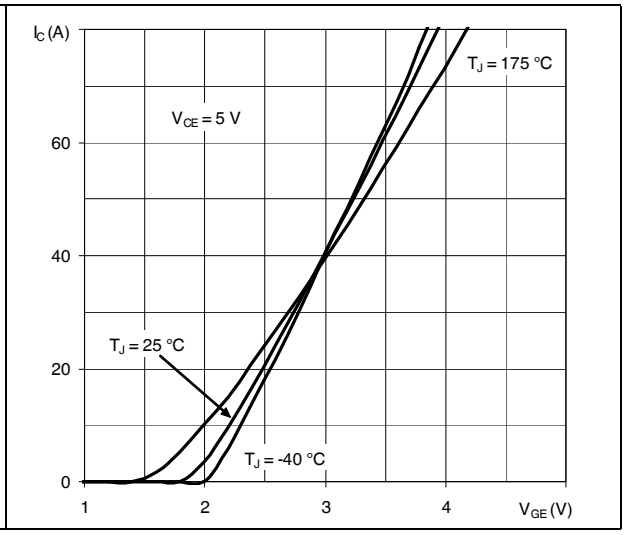


Figure 8. Collector cut-off current vs temperature

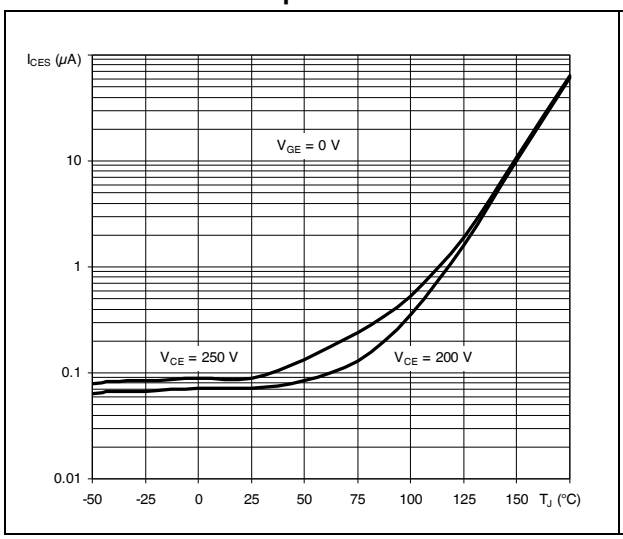


Figure 9. Normalized collector emitter voltage vs temperature

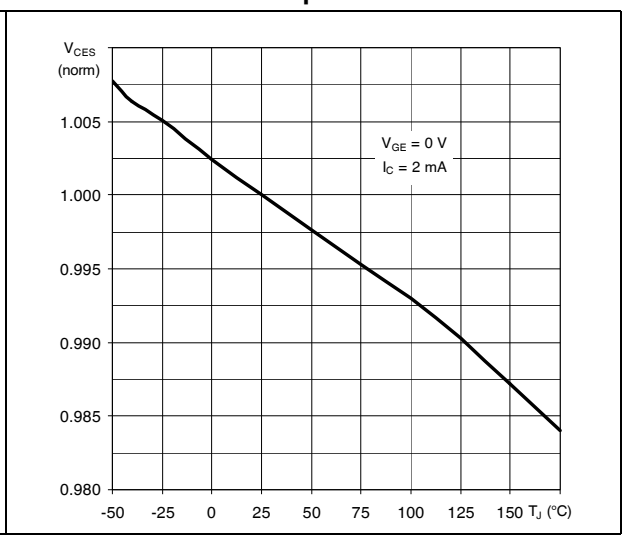


Figure 10. Normalized gate threshold voltage vs temperature

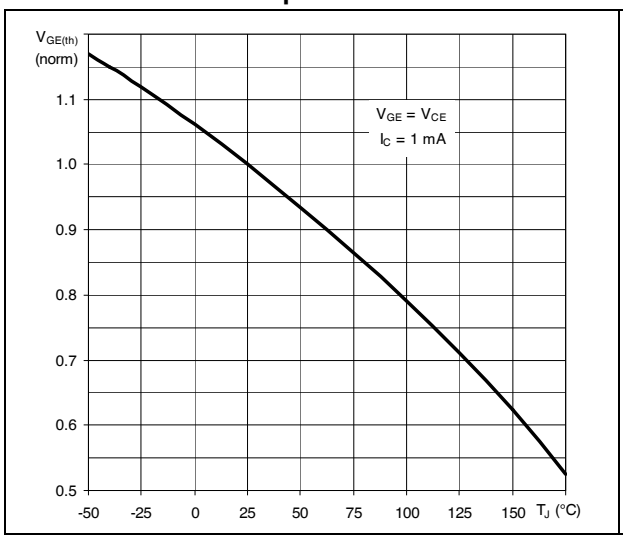


Figure 11. Gate charge

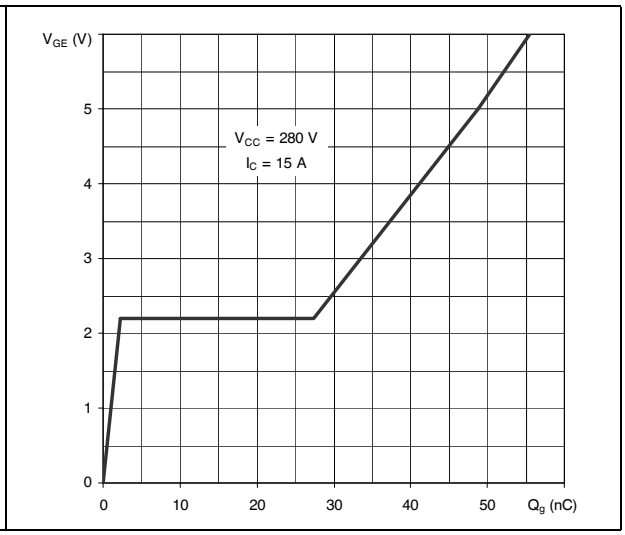
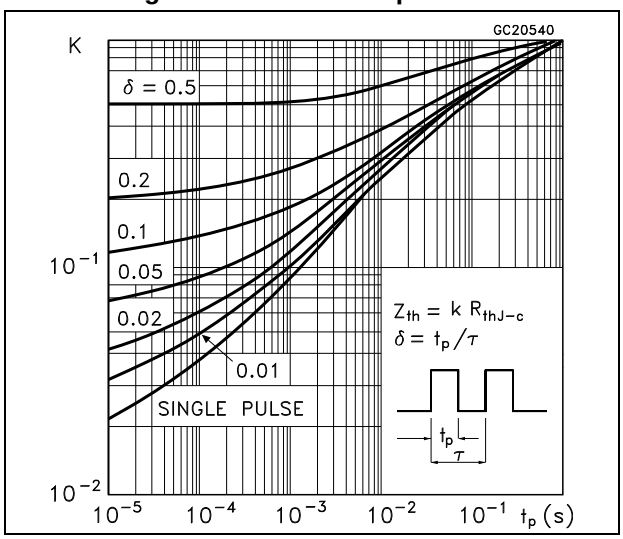


Figure 12. Thermal impedance



3 Test circuits

Figure 13. Test circuit for inductive load switching

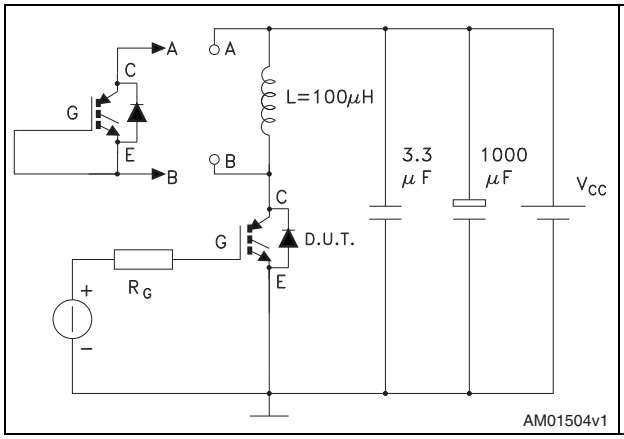


Figure 14. Gate charge test circuit

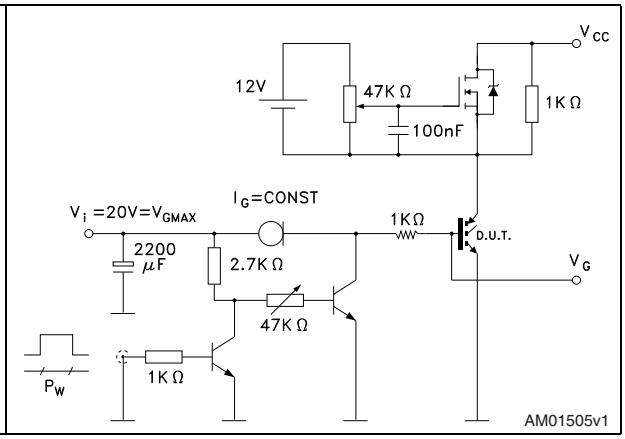
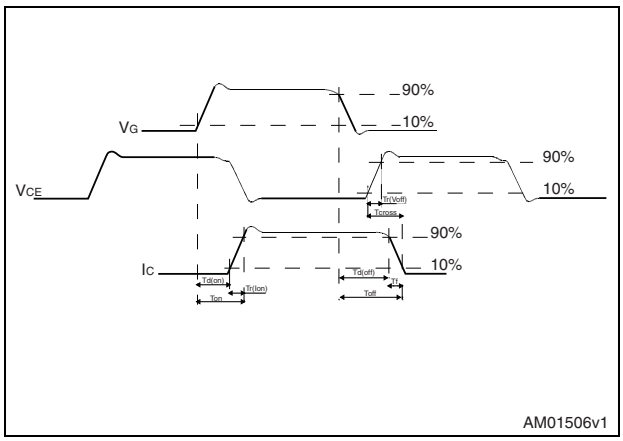


Figure 15. Switching waveform



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.

Table 8. D²PAK (TO-263) 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		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 16. D²PAK (TO-263) drawing

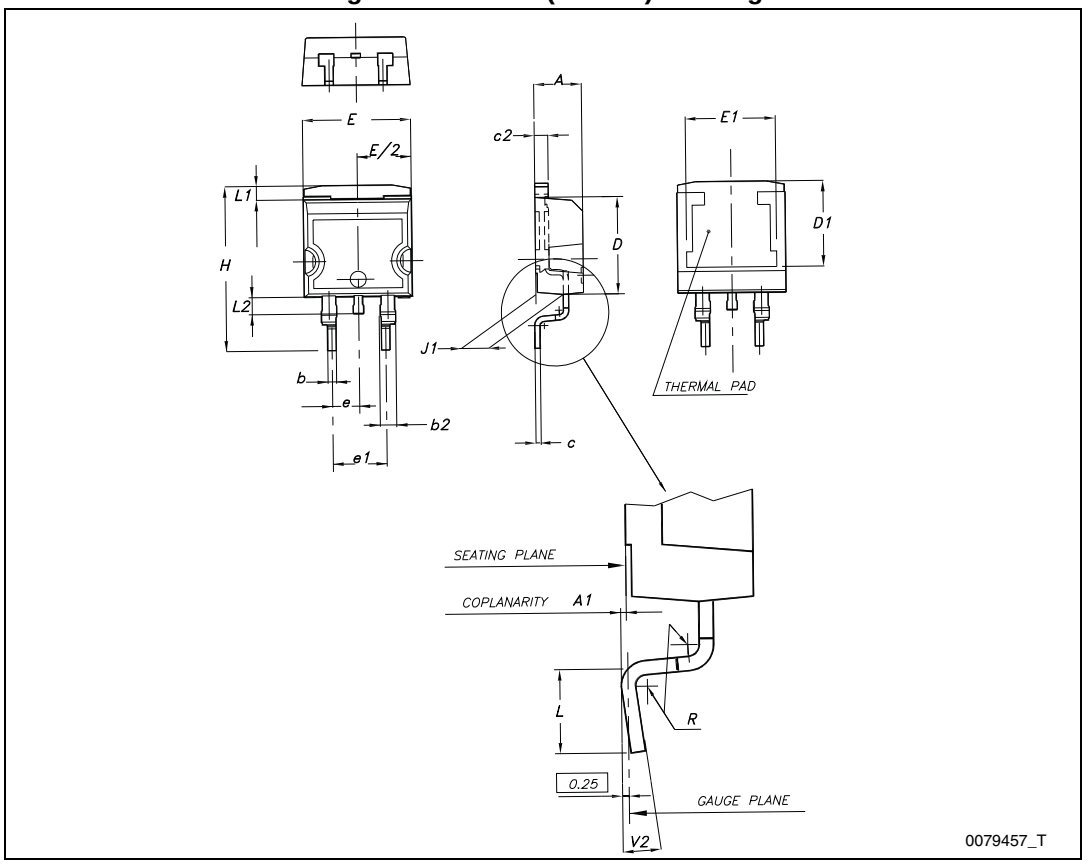
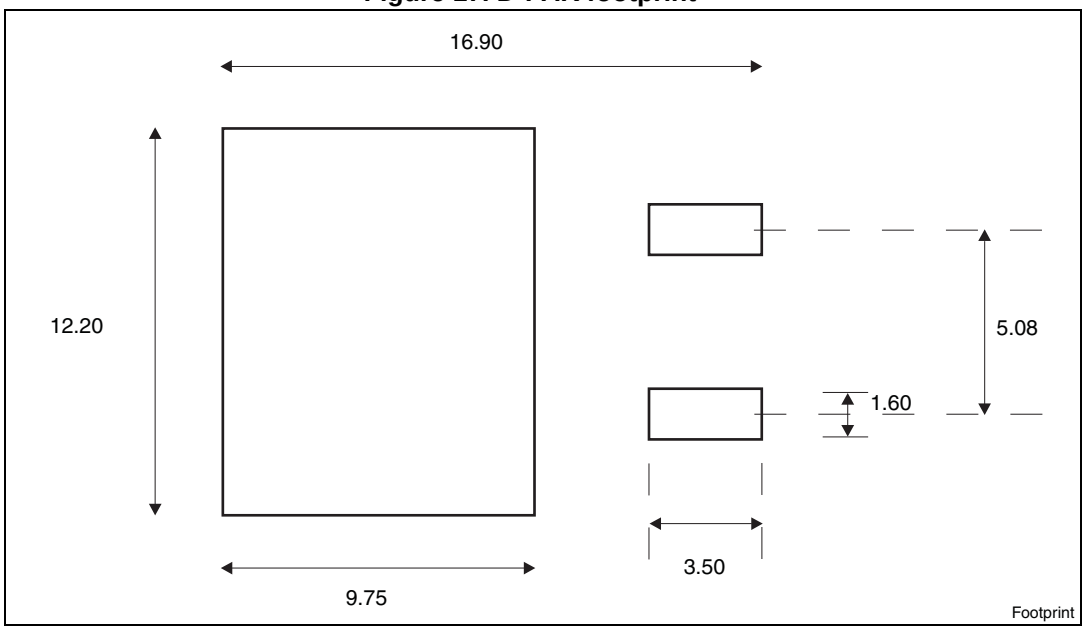


Figure 17. D²PAK footprint[a]



a. All dimension are in millimeters

Table 9. I²PAK (TO-262) mechanical data

DIM.	mm.		
	min.	typ	max.
A	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
e	2.40		2.70
e1	4.95		5.15
E	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

Figure 18. I²PAK (TO-262) drawing

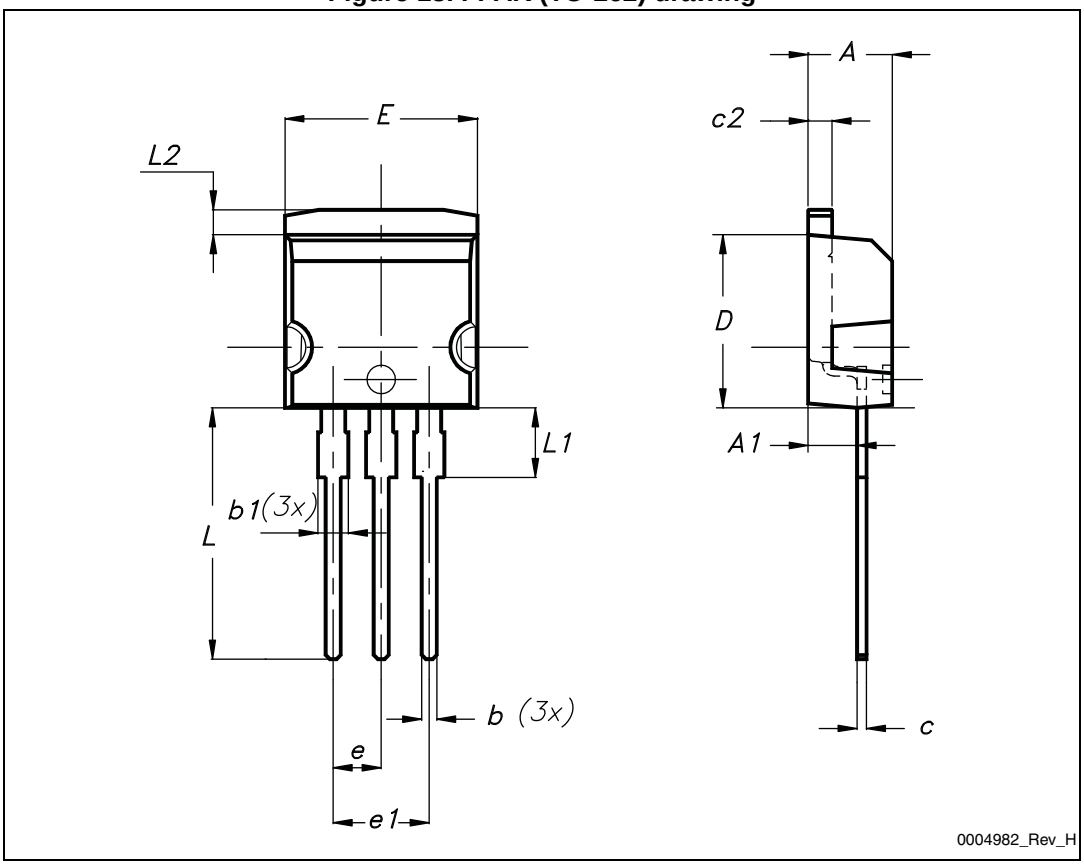
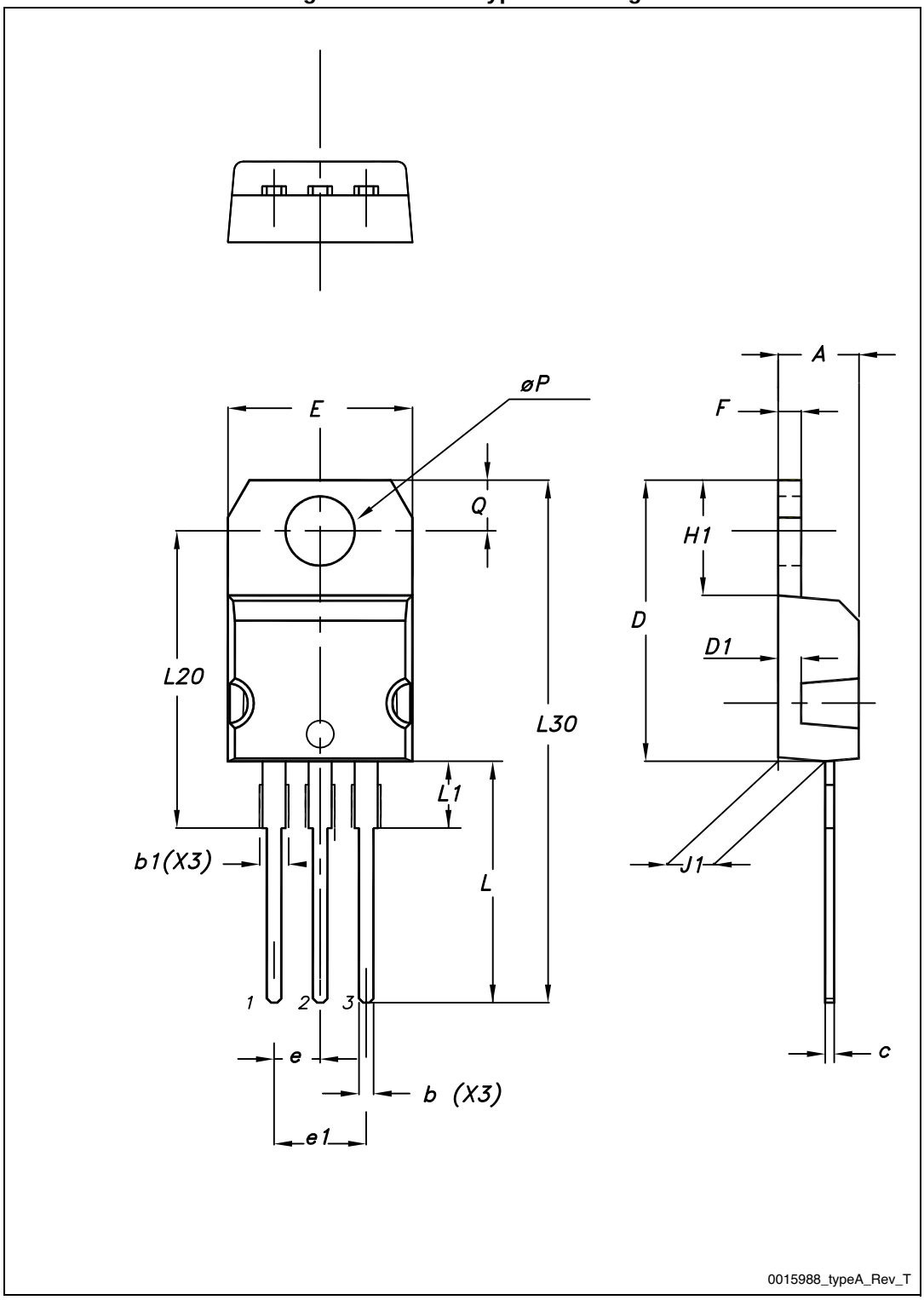


Table 10. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95

Figure 19. TO-220 type A drawing



5 Packaging mechanical data

Table 11. D²PAK (TO-263) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 20. Tape for D²PAK (TO-263)

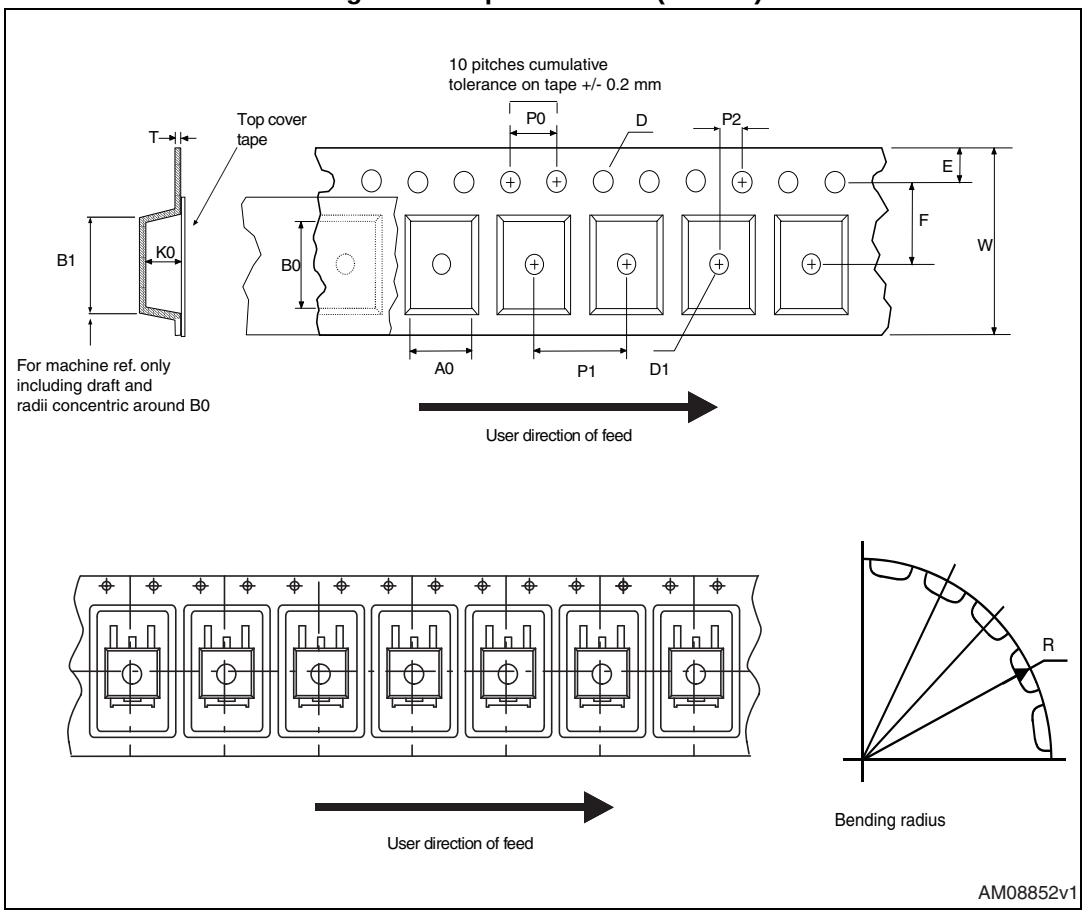
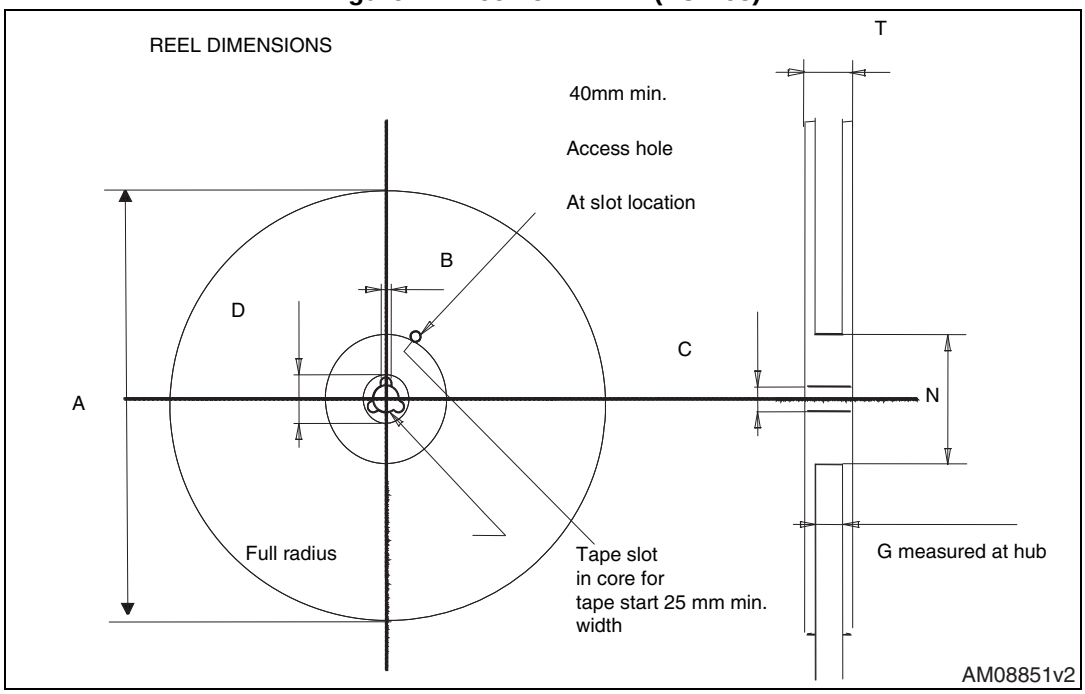


Figure 21. Reel for D²PAK (TO-263)



6 Revision history

Table 12. Document revision history

Date	Revision	Changes
29-Mar-2006	1	Initial release.
03-Jun-2009	2	Document status promoted from preliminary data to datasheet.
05-Nov-2009	3	Inserted *Chapter 2.1: Electrical characteristics (curves)*
16-Feb-2010	4	Added new package, mechanical data: TO-220
03-Jun-2010	5	– Added *Figure 12: Thermal impedance* – Modifed *Figure 4*, *Figure 5*, *Figure 6* and *Figure 7* – D²PAK mechanical data has been updated
28-May-2013	6	– Updated title in cover page, *Chapter 5: Packaging mechanical data* and *Chapter 5: Packaging mechanical data*.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST’s terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST’S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER’S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR “AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL” INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.
Information in this document supersedes and replaces all information previously supplied.
The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com