ACTT6B-800E

AC Thyristor Triac power switch

Rev.03 - 08 January 2023 Product data sheet

1. General description

AC Thyristor Triac power switch in a TO263 (D2PAK) surface mountable plastic package with self-protective clamping capabilities against low and high energy transients.

2. Features and benefits

- Clamping structure ensuring safe high over-voltage withstand capability
- Direct interfacing with low power drivers and microcontrollers
- Full cycle AC conduction
- Over-voltage withstand capability to IEC 61000-4-5
- Pin compatible with standard triacs
- Planar passivated for voltage ruggedness and reliability
- Protective self turn-on capability for high energy transients
- Safe clamping capability for low energy over-voltage transients
- Sensitive gate for easy logic level triggering
- Surface mountable package
- Triggering in three quadrants only
- Very high immunity to false turn-on by dV/dt

3. Applications

- AC fan, pump and compressor controls
- Highly inductive, resistive and safety loads
- Large and small appliances (White Goods)
- Reversing induction motor controls

4. Quick reference data

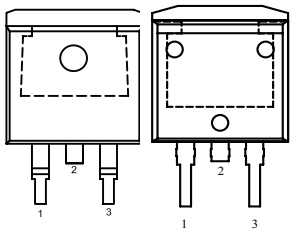
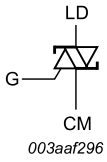
Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage			-	-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 108$ °C; Fig. 1; Fig. 2; Fig. 3		-	-	6	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25$ °C; $t_p = 20$ ms; Fig. 4; Fig. 5		-	-	51	A
		full sine wave; $T_{j(init)} = 25$ °C; $t_p = 16.7$ ms		-	-	56	A
T_j	junction temperature			-	-	125	°C
V_{PP}	peak pulse voltage	$T_j = 25$ °C; non-repetitive; off-state; Fig. 6		-	-	2	kV
Static characteristics							
I_{GT}	gate trigger current	$V_D = 12$ V; $I_T = 100$ mA; LD+ G+; $T_j = 25$ °C; Fig. 8		-	-	10	mA
		$V_D = 12$ V; $I_T = 100$ mA; LD+ G-; $T_j = 25$ °C; Fig. 8		-	-	10	mA
		$V_D = 12$ V; $I_T = 100$ mA; LD- G-; $T_j = 25$ °C; Fig. 8		-	-	10	mA

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 10		-	-	25	mA
V_T	on-state voltage	I_T = 8 A; T_j = 25 °C; Fig. 11		-	-	1.7	V
V_{CL}	clamping voltage	I_{CL} = 0.1 mA; t_p = 1 ms; T_j = 25 °C		850	-	-	V
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 536 V; T_j = 125 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit; Fig. 13		500	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 6 A; dV_{com}/dt = 20 V/µs; (snubberless condition); gate open circuit; Fig. 14; Fig. 15		3.5	-	-	A/ms
		V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 6 A; dV_{com}/dt = 10 V/µs; gate open circuit; Fig. 14; Fig. 15		5	-	-	A/ms
		V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 6 A; dV_{com}/dt = 1 V/µs; gate open circuit; Fig. 14; Fig. 15		10	-	-	A/ms

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	CM	common		
2	LD	load		
3	G	gate		
mb	LD	mounting base; load		

6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
ACTT6B-800E	TO263	ACTT6B-800E,118	Reel	800	TO263N (N)	26-Sep-2016
					TO263P (P)	12-Jun-2023

7. Marking

Table 4. Marking codes

Type number	Marking codes	
	Assembly factory: N	Assembly factory: P
ACTT6B-800E	ACTT6B 800E PJNxxxx xx	ACTT6B 800E PJPxxxx xx

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Notes	Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage			-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 108$ °C; Fig. 1; Fig. 2; Fig. 3		-	6	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25$ °C; $t_p = 20$ ms; Fig 4; Fig 5		-	51	A
		full sine wave; $T_{j(init)} = 25$ °C; $t_p = 16.7$ ms		-	56	A
I^2t	I^2t for fusing	$t_p = 10$ ms; sine-wave pulse		-	13	A^2s
dI_T/dt	rate of rise of on-state current	$I_G = 20$ mA		-	100	A/µs
I_{GM}	peak gate current	$t_p = 20$ µs		-	2	A
P_{GM}	peak gate power			-	5	W
$P_{G(AV)}$	average gate power	over any 20 ms period		-	0.5	W
T_{stg}	storage temperature			-40	150	°C
T_j	junction temperature			-	125	°C
V_{pp}	peak pulse voltage	$T_j = 25$ °C; non-repetitive, off-state; Fig 6		-	2	kV

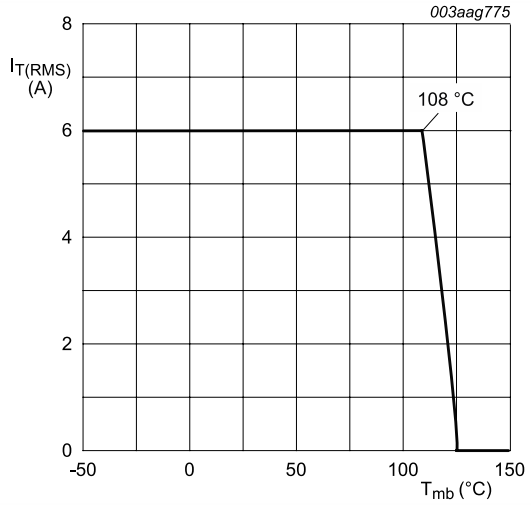
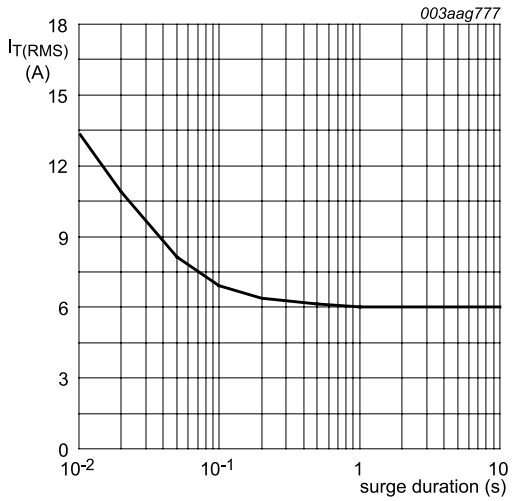
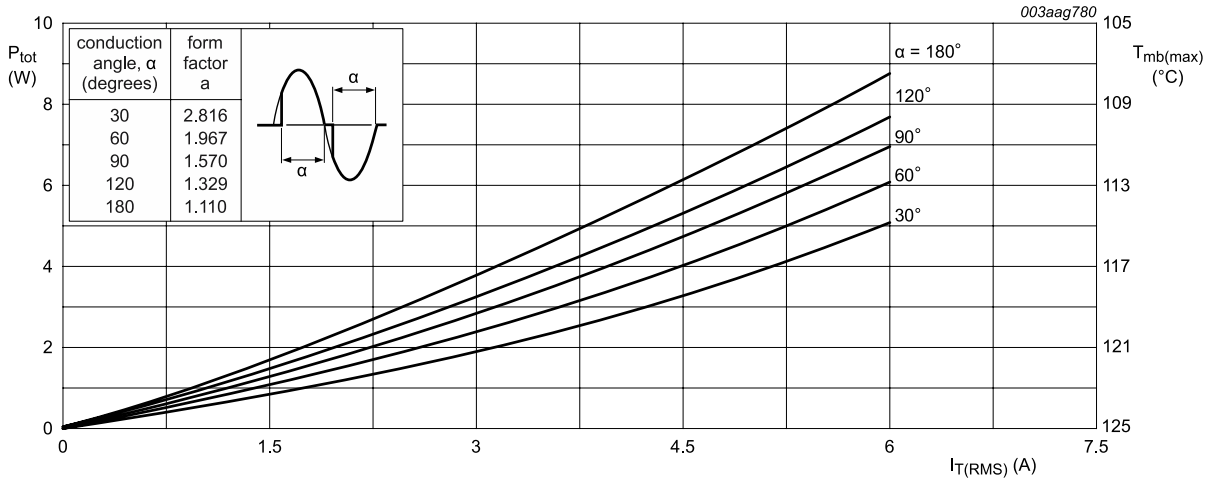


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values



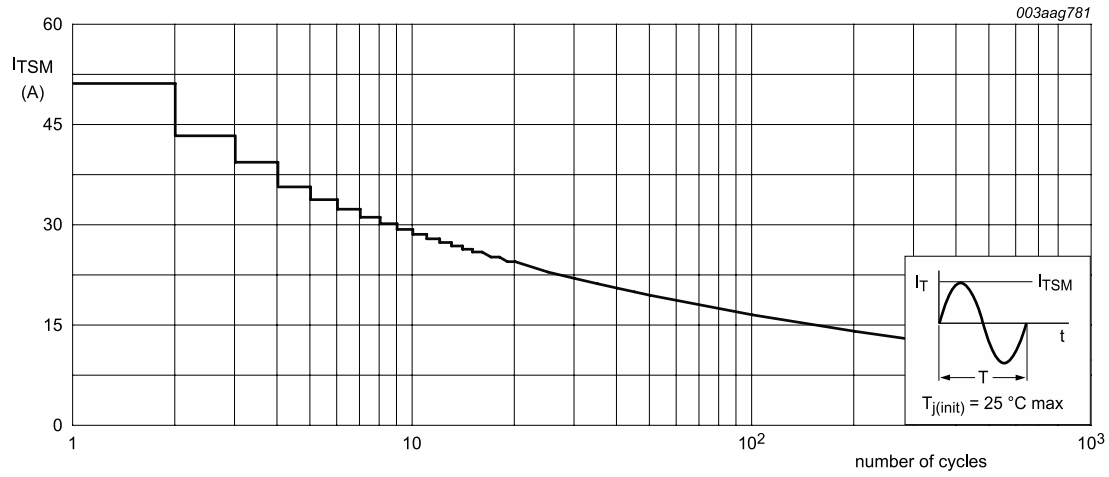
f = 50 Hz; $T_{mb} = 108$ °C

Fig. 2. RMS on-state current as a function of surge duration; maximum values



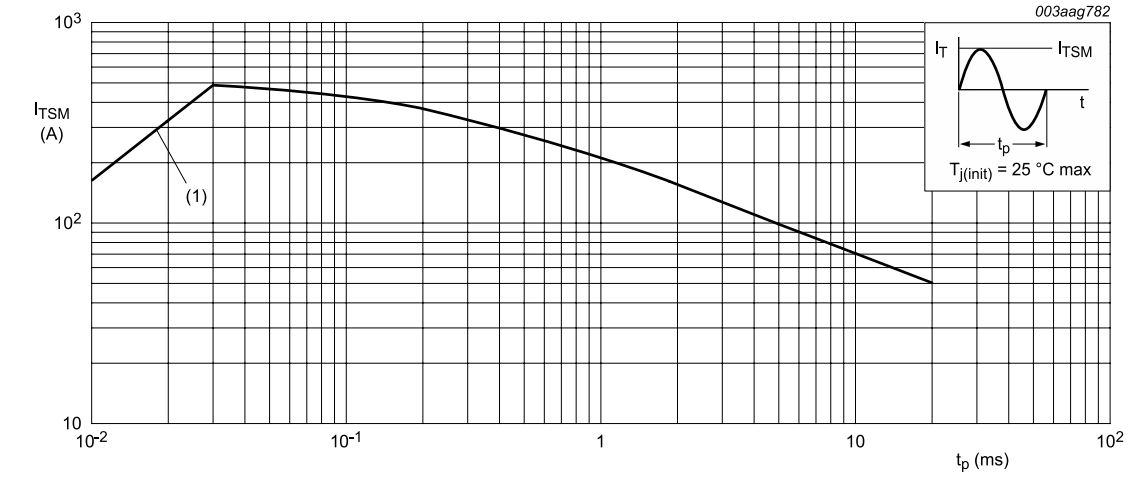
α = conduction angle
a = form factor = $I_{T(RMS)}$ / $I_{T(AV)}$

Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values



f = 50 Hz

Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20$ ms
(1) dI_T/dt limit

Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

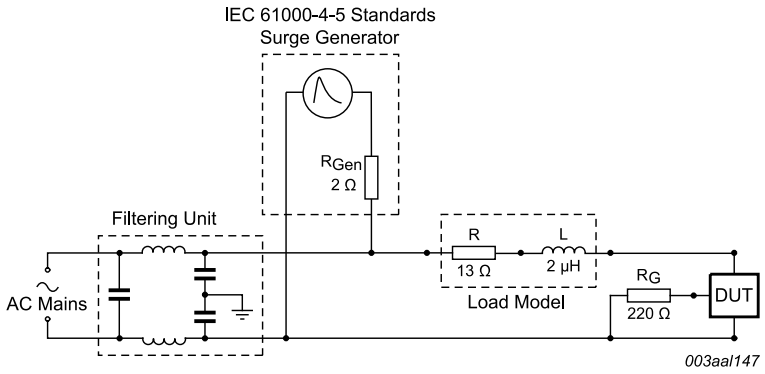
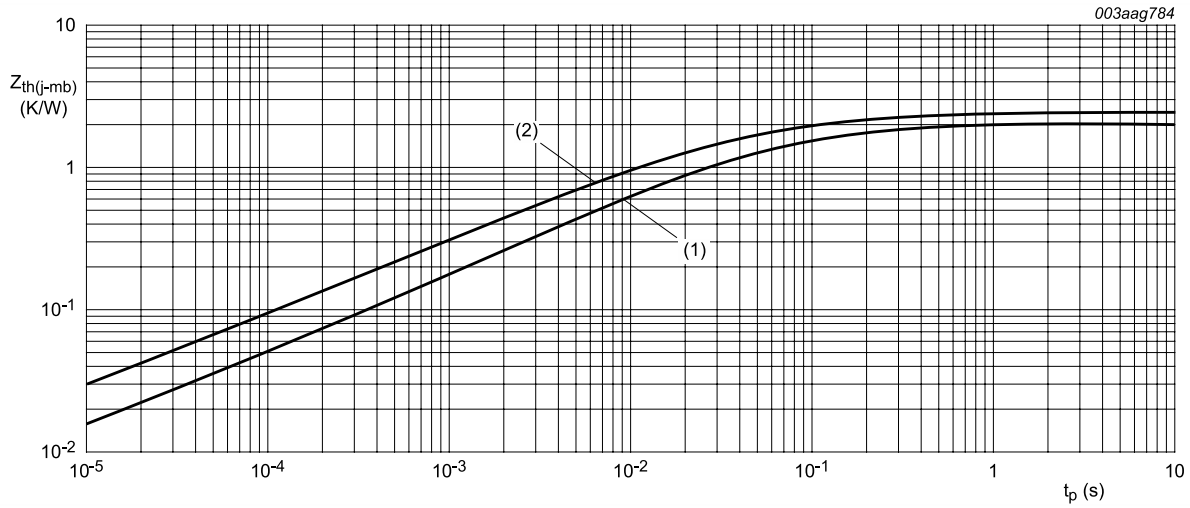


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	full cycle; Fig. 7		-	-	2.4	K/W
		half cycle; Fig. 7		-	-	2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	printed circuit board (FR4) mounted		-	55	-	K/W



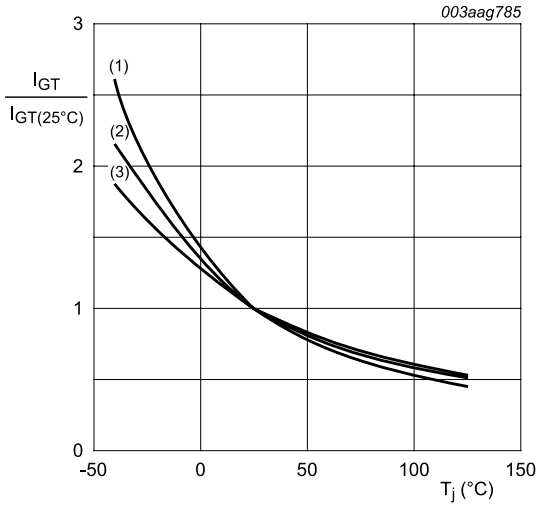
(1) Bidirectional (full cycle)
(2) Unidirectional (half cycle)

Fig. 7. Transient thermal impedance from junction to mounting base as a function of pulse width

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
I_{GT}	gate trigger current	V_D = 12 V; I_T = 100 mA; LD+ G+; T_j = 25 °C; Fig. 8		-	-	10	mA
		V_D = 12 V; I_T = 100 mA; LD+ G-; T_j = 25 °C; Fig. 8		-	-	10	mA
		V_D = 12 V; I_T = 100 mA; LD- G-; T_j = 25 °C; Fig. 8		-	-	10	mA
I_L	latching current	V_D = 12 V; I_G = 100 mA; LD+ G+; T_j = 25 °C; Fig. 9		-	-	30	mA
		V_D = 12 V; I_G = 100 mA; LD+ G-; T_j = 25 °C; Fig. 9		-	-	40	mA
		V_D = 12 V; I_G = 100 mA; LD- G-; T_j = 25 °C; Fig. 9		-	-	30	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 10		-	-	25	mA
V_T	on-state voltage	I_T = 8 A; T_j = 25 °C; Fig. 11		-	-	1.7	V
V_{GT}	gate trigger voltage	V_D = 12V; I_T = 100 mA;T_j = 25 °C; Fig. 12		-	0.8	1	V
		V_D = 400V; I_T = 100 mA;T_j = 125 °C; Fig. 12		0.2	0.45	-	V
I_D	off-state current	V_D = 800 V; T_j = 25 °C		-	-	10	µA
		V_D = 800 V; T_j = 125 °C		-	-	0.5	mA
V_{CL}	clamping voltage	I_{CL} = 0.1 mA; t_p = 1 ms; T_j = 25 °C		850	-	-	V
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 536 V; T_j = 125 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit; Fig. 13		500	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 6 A; dV_{com}/dt = 20 V/µs; (snubberless condition); gate open circuit; Fig. 14; Fig. 15		3.5	-	-	A/ms
		V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 6 A; dV_{com}/dt = 10 V/µs; gate open circuit; Fig. 14; Fig. 15		5	-	-	A/ms
		V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 6 A; dV_{com}/dt = 1 V/µs; gate open circuit; Fig. 14; Fig. 15		10	-	-	A/ms



(1) LD- G-
(2) LD+ G+
(3) LD+ G-

Fig. 8. Normalized gate trigger current as a function of junction temperature

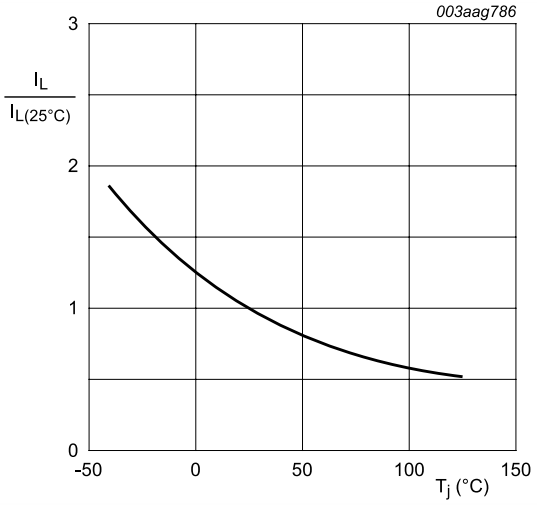


Fig. 9. Normalized latching current as a function of junction temperature

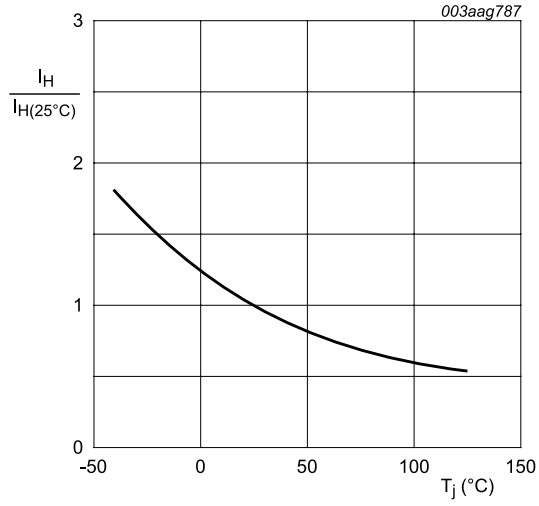
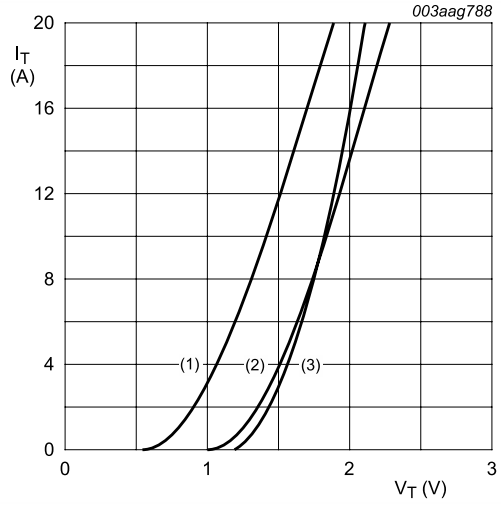


Fig. 10. Normalized holding current as a function of junction temperature



V_o = 1.109 V; R_s = 0.076 Ω
(1) T_j = 125 °C; typical values
(2) T_j = 125 °C; maximum values
(3) T_j = 25 °C; maximum values

Fig. 11. On-state current as a function of on-state voltage

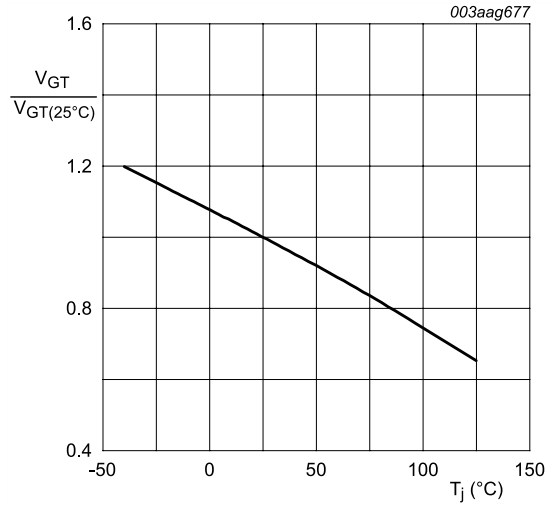
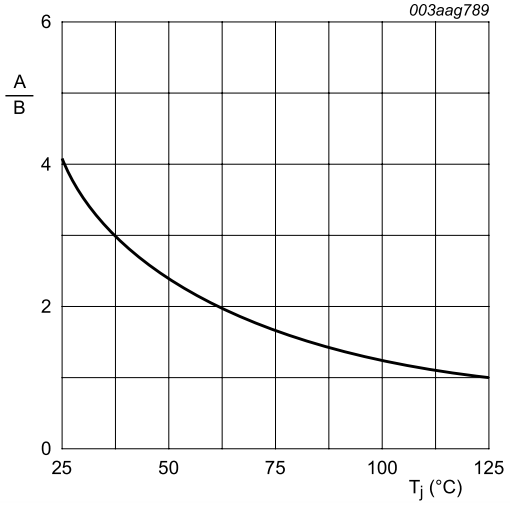
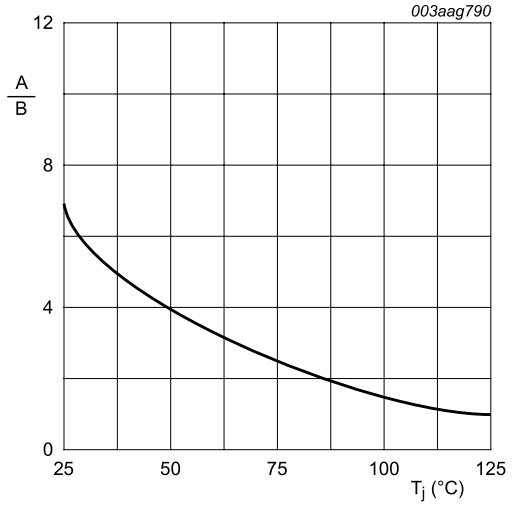


Fig. 12. Normalized gate trigger voltage as a function of junction temperature



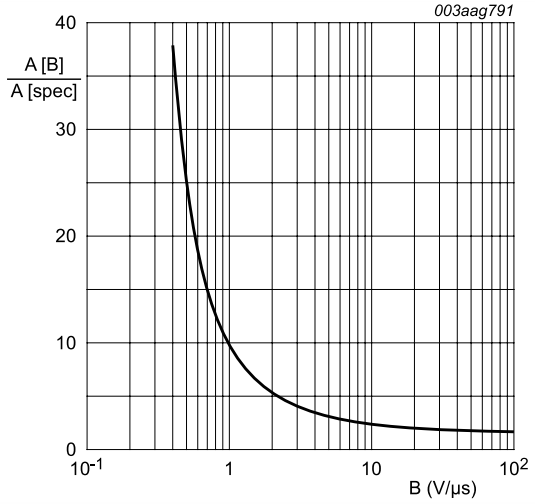
A = dV_D/dt at condition T_j °C
B = dV_D/dt at condition T_j [125] °C

Fig. 13. Normalized gate trigger voltage as a function of junction temperature



A = dI_{com}/dt at condition T_j °C
B = dI_{com}/dt at condition T_j [125] °C
V_D = 400 V

Fig. 12. Normalized critical rate of rise of commutating current as a function of junction temperature



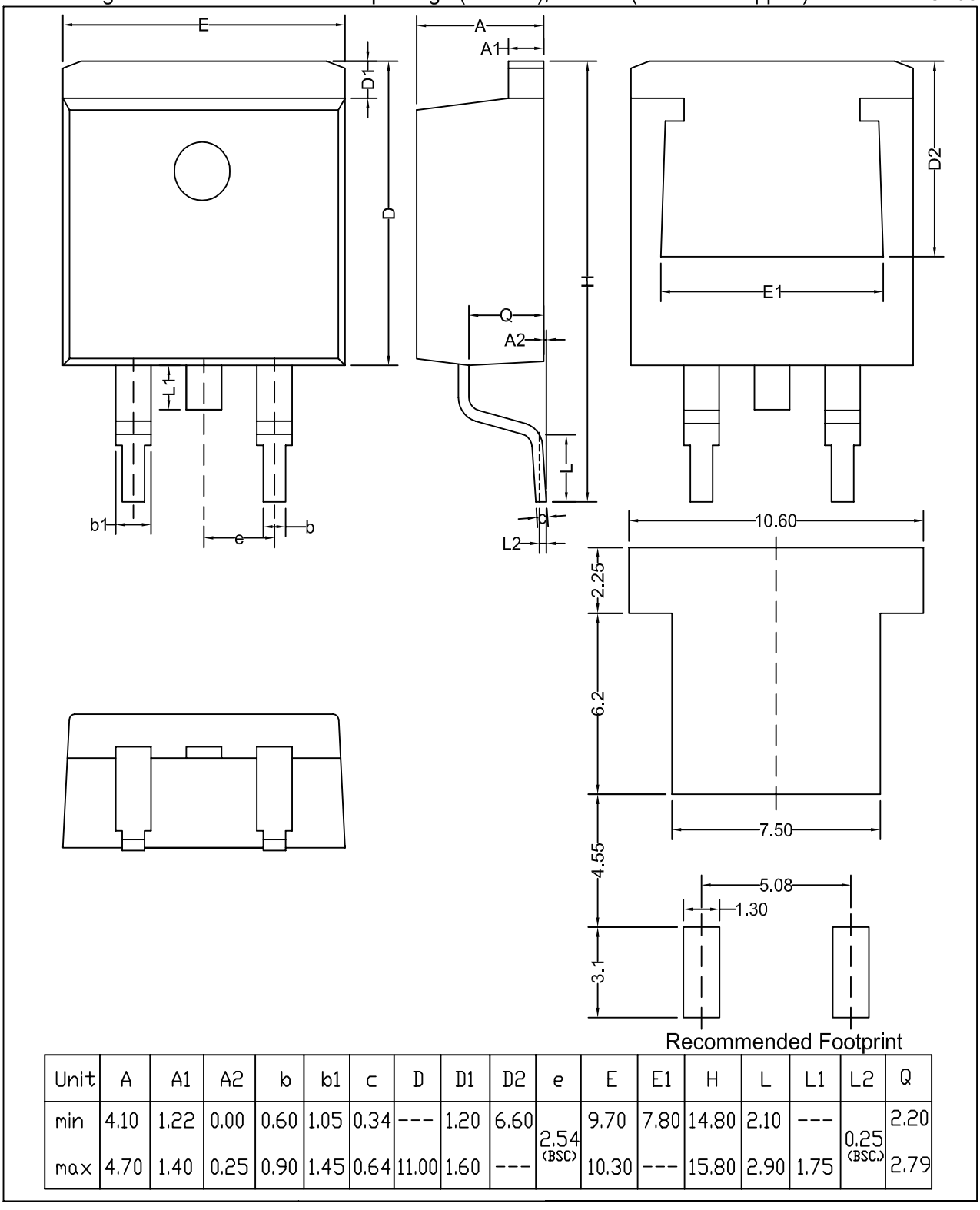
A [B] is dI_{com}/dt at condition B, dV_{com}/dt
A [spec] is the specified data sheet value of dI_{com}/dt
turn-off time < 20 ms

Fig. 12. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values

11. Package outline

Assembly factory: N

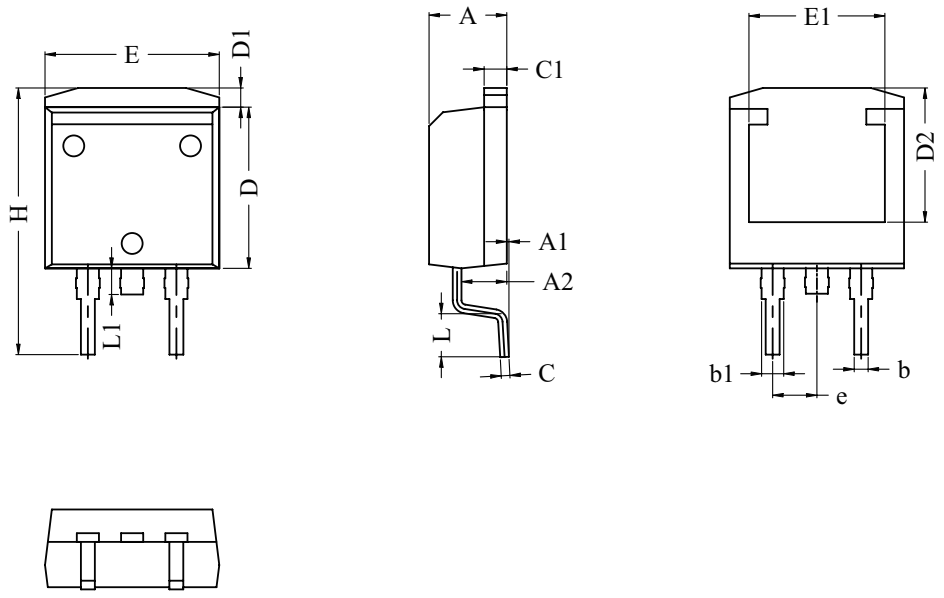
Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) TO263



Unit	A	A1	A2	b	b1	c	D	D1	D2	e	E	E1	H	L	L1	L2	Q
min	4.10	1.22	0.00	0.60	1.05	0.34	---	1.20	6.60	2.54 (BSC)	9.70	7.80	14.80	2.10	---	0.25 (BSC)	2.20
max	4.70	1.40	0.25	0.90	1.45	0.64	11.00	1.60	---		10.30	---	15.80	2.90	1.75		2.79

Assembly factory: P

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) TO263



Dim	All Dimensions in Millimeters		
	Min	Typ	Max
A	4.30	4.46	4.60
A1	0	0.13	0.25
A2	2.50	2.60	2.70
b	0.70	0.80	0.90
b1	1.10	1.27	1.45
C	0.40	0.52	0.60
C1	1.17	1.30	1.40
D	9.10	9.25	9.40
D1	1.00	1.10	1.30
D2	7.40	7.70	8.00
E	9.80	10.00	10.20
E1	7.60	7.80	8.00
e	2.54 BSC		
H	14.80	15.30	15.80
L	2.10	2.47	2.80
L1	1.30	1.50	1.70

12. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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