STDLED602, STULED602

N-channel 600 V, 4 Ω typ., 2 A Power MOSFET in DPAK and IPAK packages

Datasheet – preliminary data

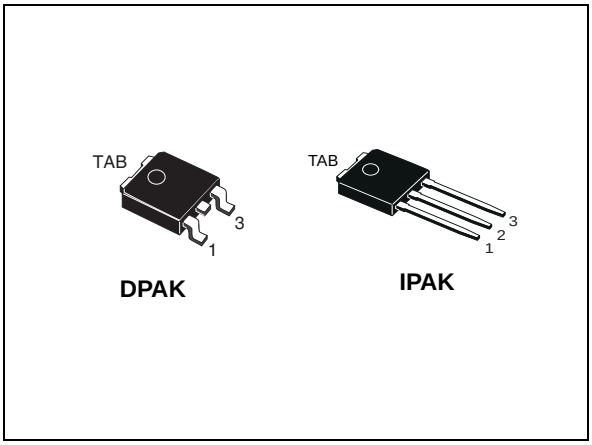
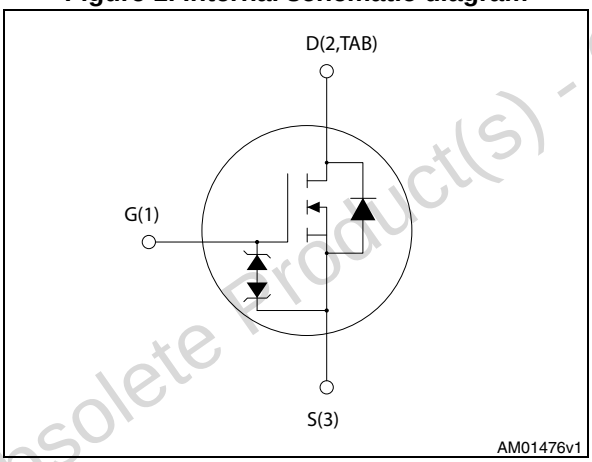


Figure 1. Internal schematic diagram



Features

Order codes	V_{DS}	$R_{DS(on)}$max.	I_D	P_{TOT}
STDLED602	600 V	4.5 Ω	2 A	45 W
STULED602				

- 100% avalanche tested
- Extremely high dv/dt capability
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

Applications

- LED lighting application

Description

These Power MOSFETs boast extremely low on-resistance, superior dynamic performance and high avalanche capability, making them suitable for the buck-boost and flyback topology.

Obsolete Product(s) - Obsolete Product(s)

Table 1. Device summary

Order codes	Marking	Package	Packaging
STDLED602	LED602	DPAK	Tape and reel
STULED602		IPAK	Tube

This is preliminary information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

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Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at T_C = 25 °C	2	A
I_D	Drain current (continuous) at T_C = 100 °C	1.26	A
I_{DM} (1)	Drain current (pulsed)	8	A
P_{TOT}	Total dissipation at T_C = 25 °C	45	W
	Derating factor	0.36	W/°C
ESD	Gate-source human body model (C = 100 pF, R = 1.5 kΩ)	2.5	kV
dv/dt (2)	Peak diode recovery voltage slope	12	V/ns
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Max. operating junction temperature	150	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 2$ A, di/dt $\leq$ 400 A/µs, peak $V_{DS} < V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		DPAK	IPAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	2.78	2.78	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max	50		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-amb max		100	°C/W

1. When mounted on 1 inch² FR-4 board, 2 oz Cu

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	2	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	80	mJ

Obsolete Product(s) - Obsolete Product(s)

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	600			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0) V_{DS} = 600 V V_{DS} = 600 V, T_C=125 °C				1 50	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			± 10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.6	4.5	V
$R_{DS(on}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 1 A		4	4.5	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0	-	245 23 3.6	-	pF pF pF
$C_{o(er)}$(1)	Eq. capacitance energy related		-	10	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	7	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 480 V, I_D = 1 A, V_{GS} = 10 V (see *Figure 16*)	-	13 1.9 7.9	-	nC nC nC

1. $C_{oss\ eq}$. energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_DS increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off-delay time Fall time	V_{DD} = 300 V, I_D =1 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 15*)	-	10 8.5 23.5 21	-	ns ns ns ns

Obsolete Product(s) - Obsolete Product(s)

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		2 8	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 2 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 2 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 20*)	-	200 800 8		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 2 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 20*)	-	230 950 8.5		ns nC A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

Table 9. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	I_{GS}= ± 1 mA, I_D=0	30	-		V

The built-in back-to-back Zener diodes have been specifically designed to enhance not only the device's ESD capability, but also to make them capable of safely absorbing any voltage transients that may occasionally be applied from gate to source. In this respect, the Zener voltage is appropriate to achieve efficient and cost-effective protection of device integrity. The integrated Zener diodes thus eliminate the need for external components.

Obsolete Product(s) - Obsolete Product(s)

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

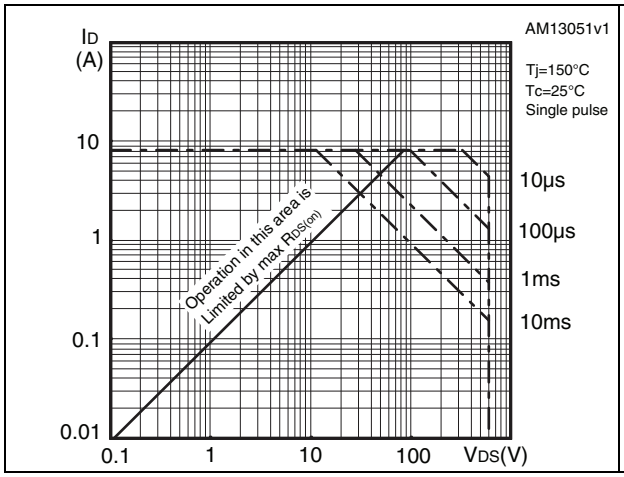


Figure 3. Thermal impedance

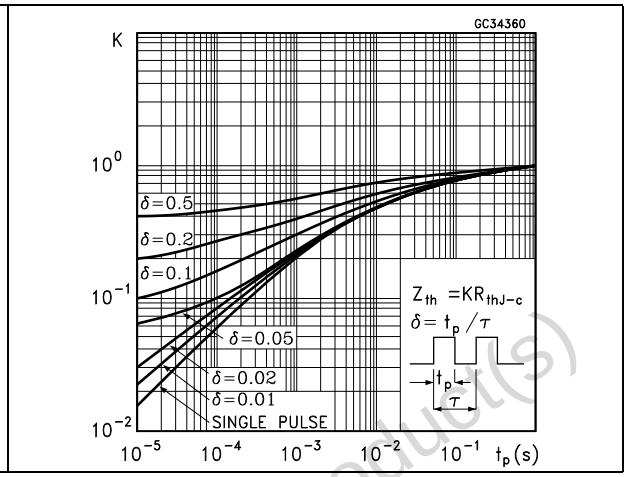


Figure 4. Output characteristics

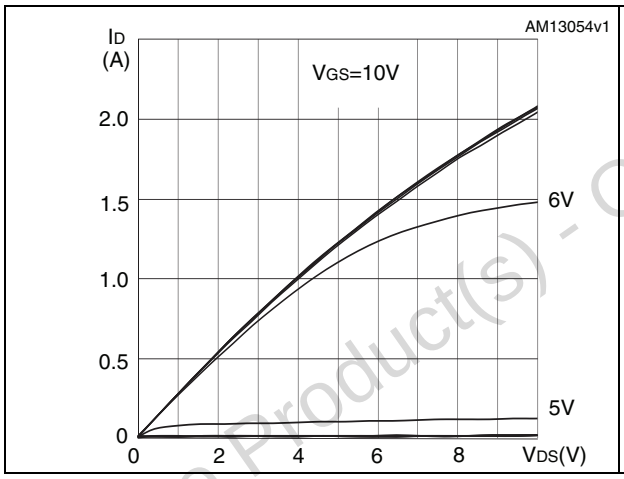


Figure 5. Transfer characteristics

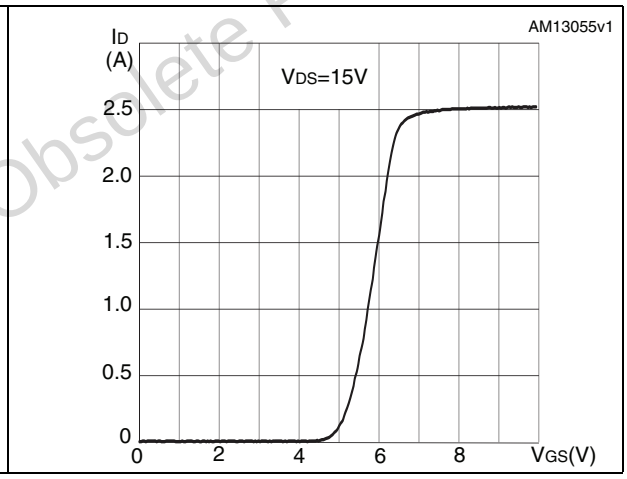


Figure 6. Gate charge vs gate-source voltage

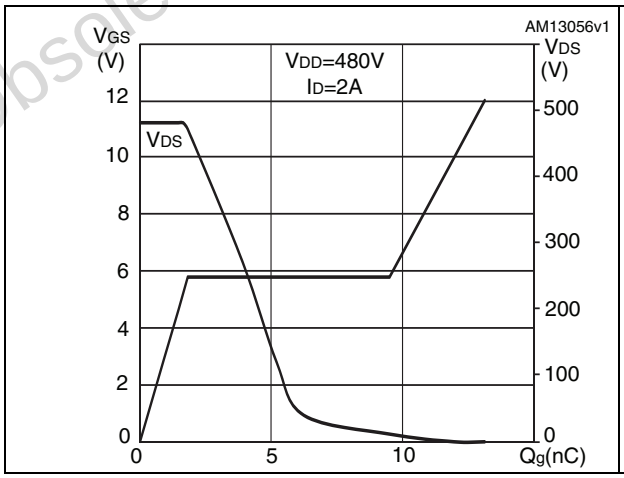
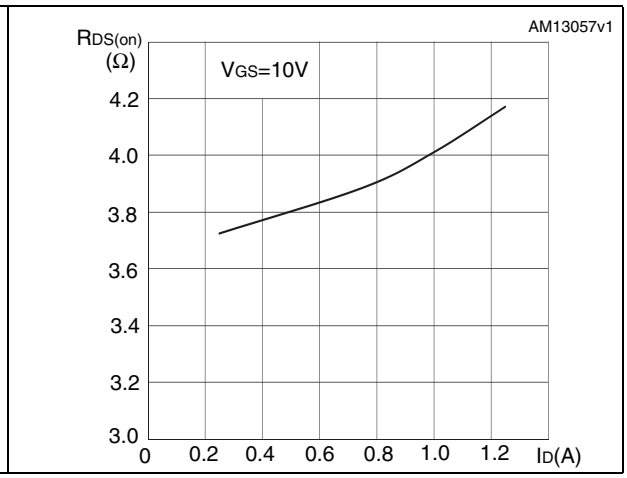


Figure 7. Static drain-source on-resistance



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Figure 8. Capacitance variations

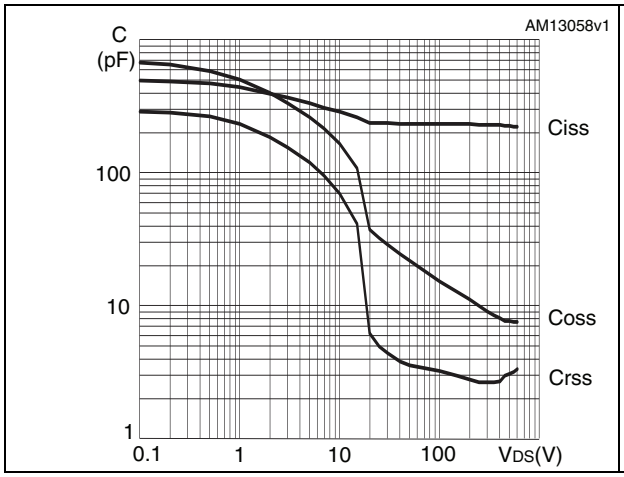


Figure 9. Output capacitance stored energy

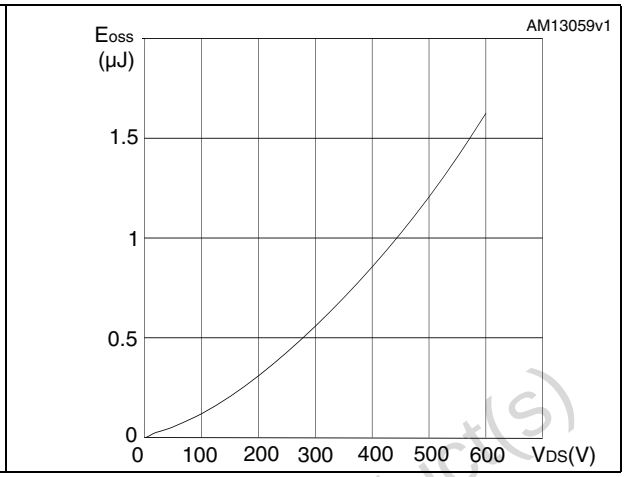


Figure 10. Normalized gate threshold voltage vs temperature

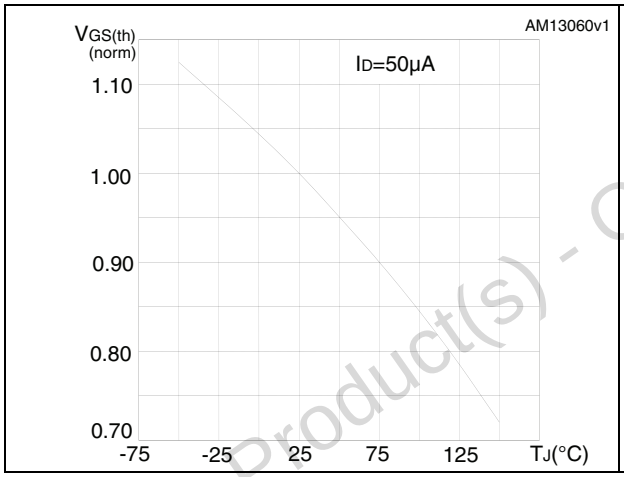


Figure 11. Normalized on-resistance vs temperature

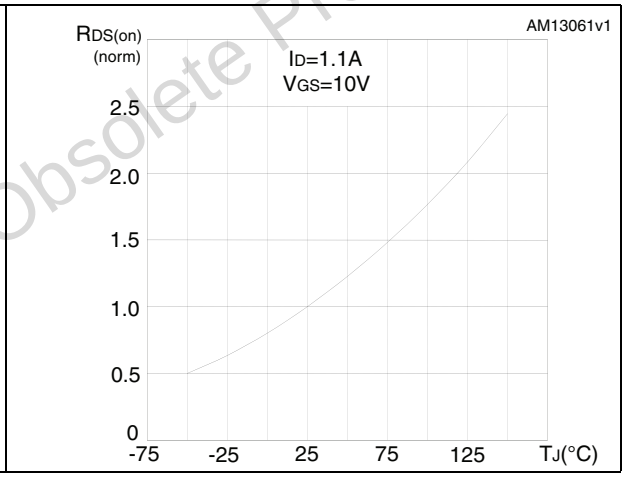


Figure 12. Normalized BV_{DSS} vs temperature

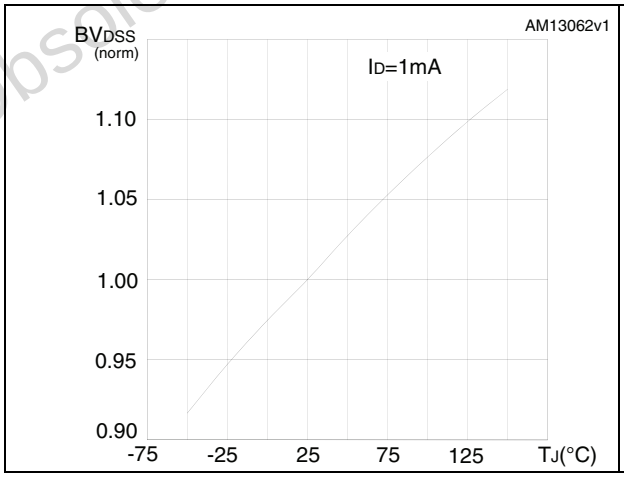
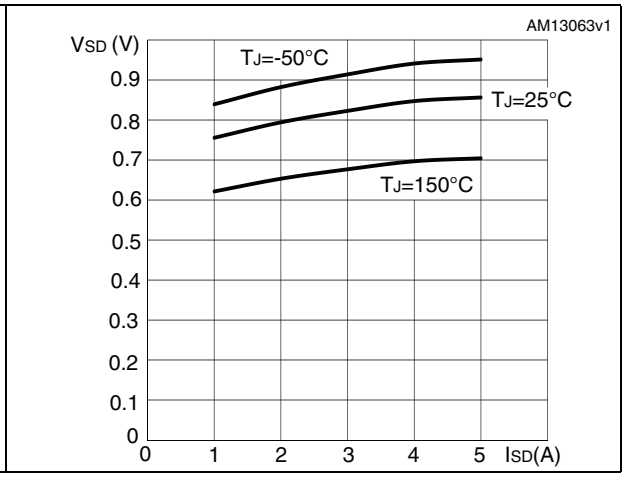
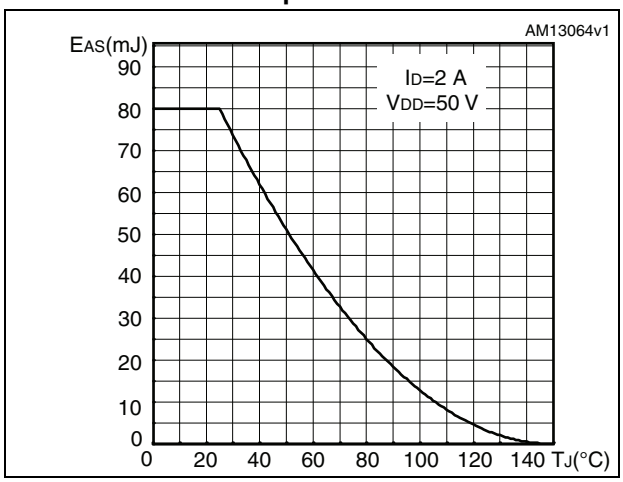


Figure 13. Source-drain diode forward characteristics



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Figure 14. Maximum avalanche energy vs temperature



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3 Test circuits

Figure 15. Switching times test circuit for resistive load

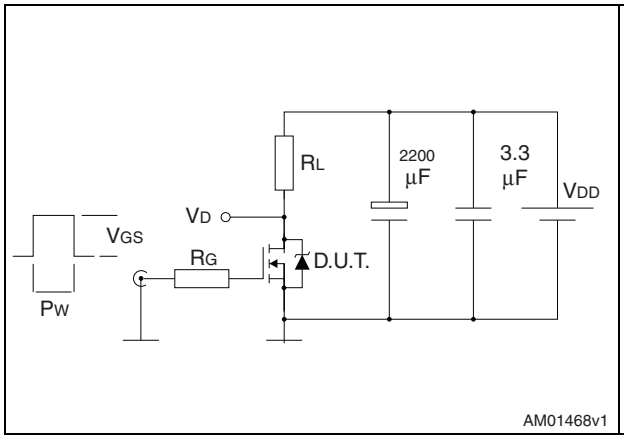


Figure 16. Gate charge test circuit

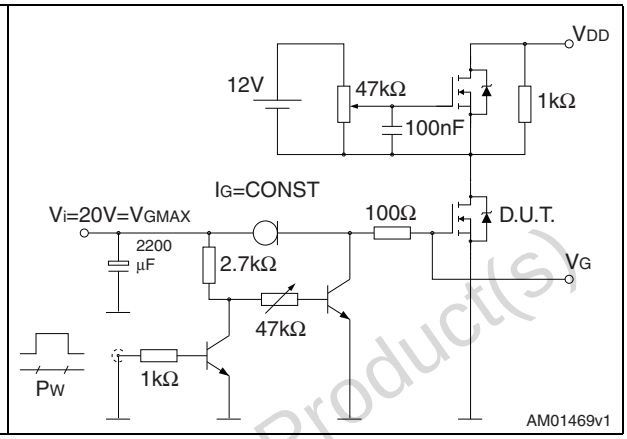


Figure 17. Test circuit for inductive load switching and diode recovery times

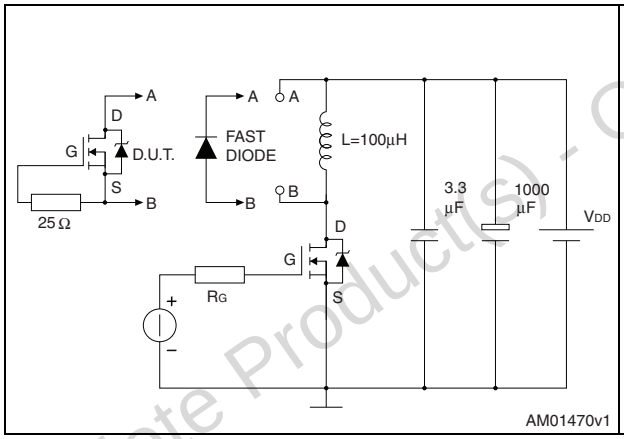


Figure 18. Unclamped Inductive load test circuit

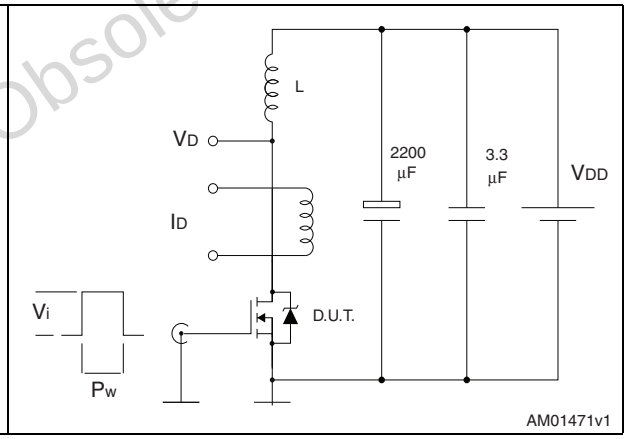


Figure 19. Unclamped inductive waveform

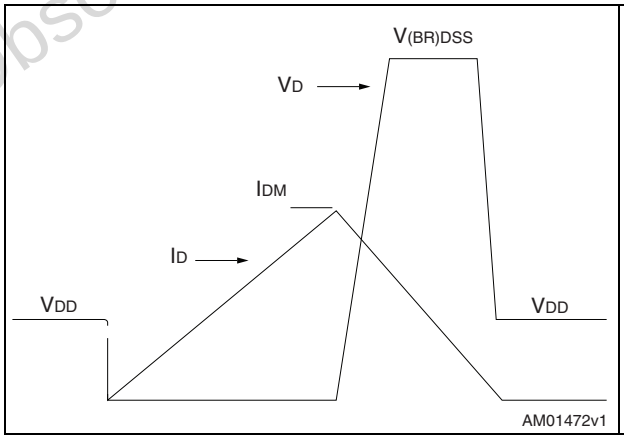
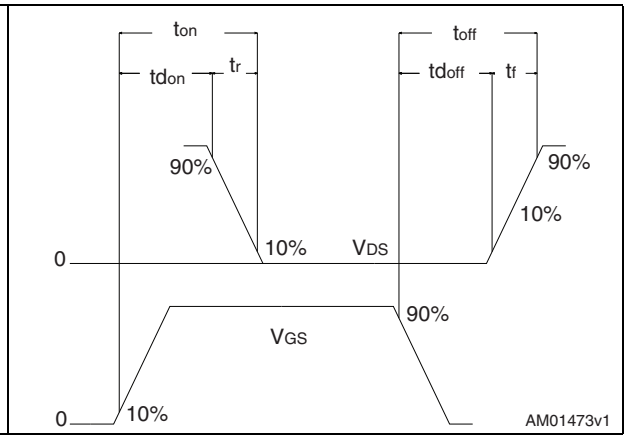


Figure 20. Switching time waveform



Obsolete Product(s) - Obsolete Product(s)

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.

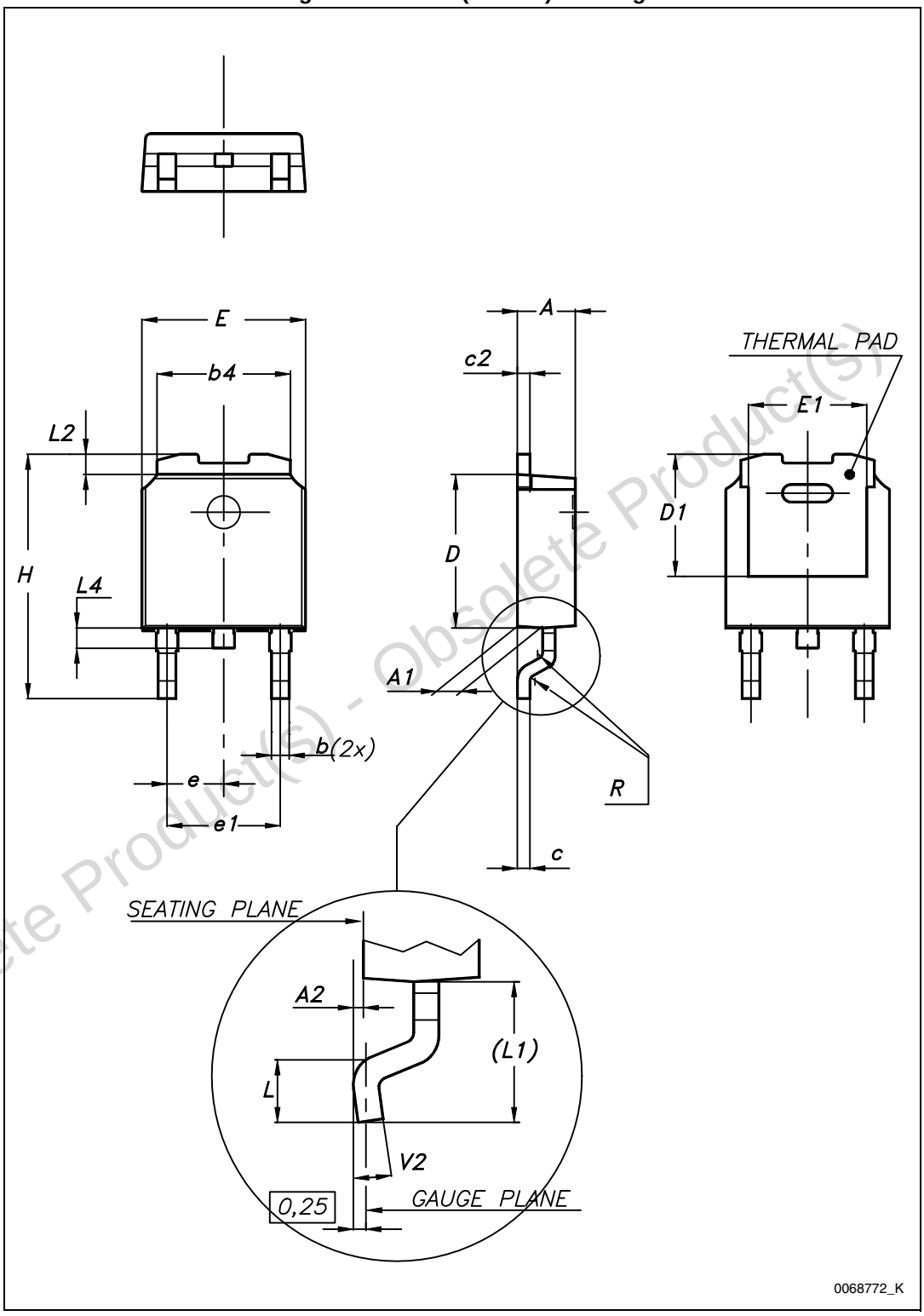
Obsolete Product(s) - Obsolete Product(s)

Table 10. DPAK (TO-252) 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	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

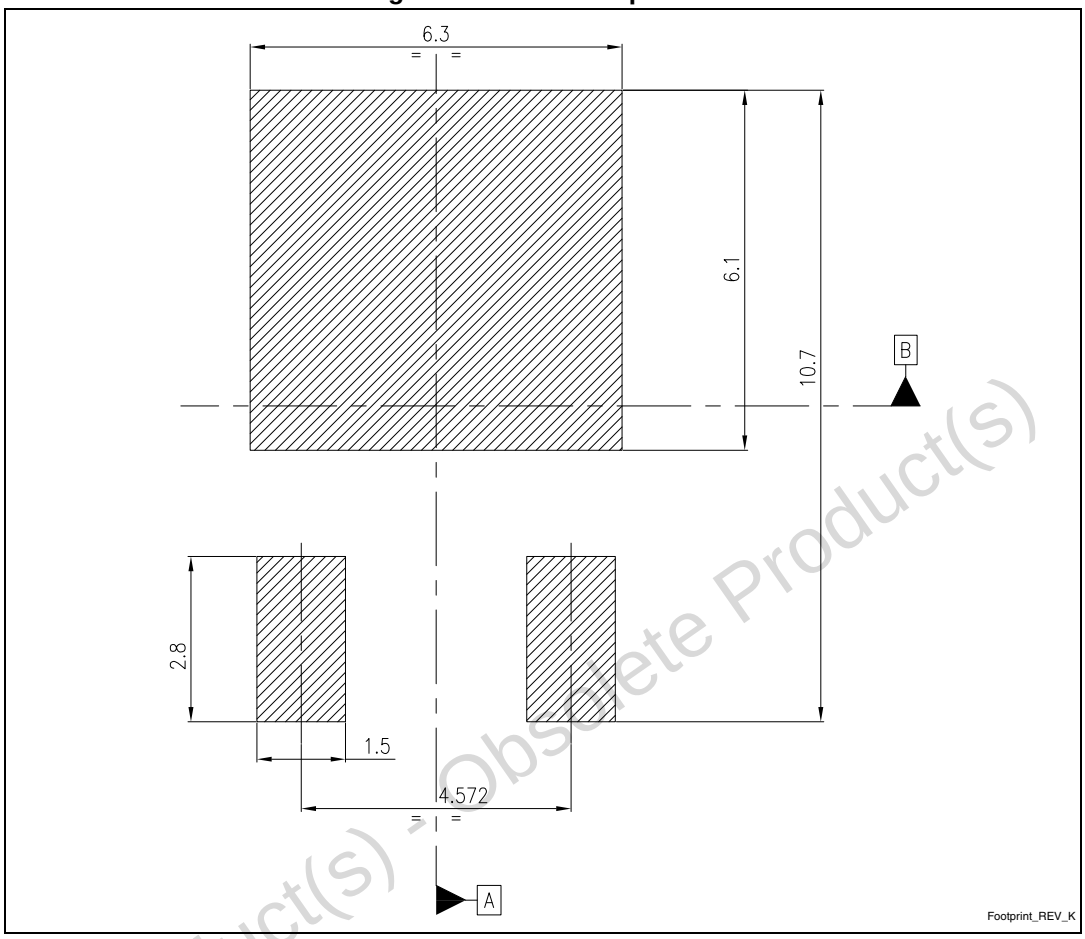
Obsolete Product(s) - Obsolete Product(s)

Figure 21. DPAK (TO-252) drawing



Obsolete Product(s) - Obsolete Product(s)

Figure 22. DPAK footprint [(a)]



Obsolete Product(s) - Obsolete Product(s)

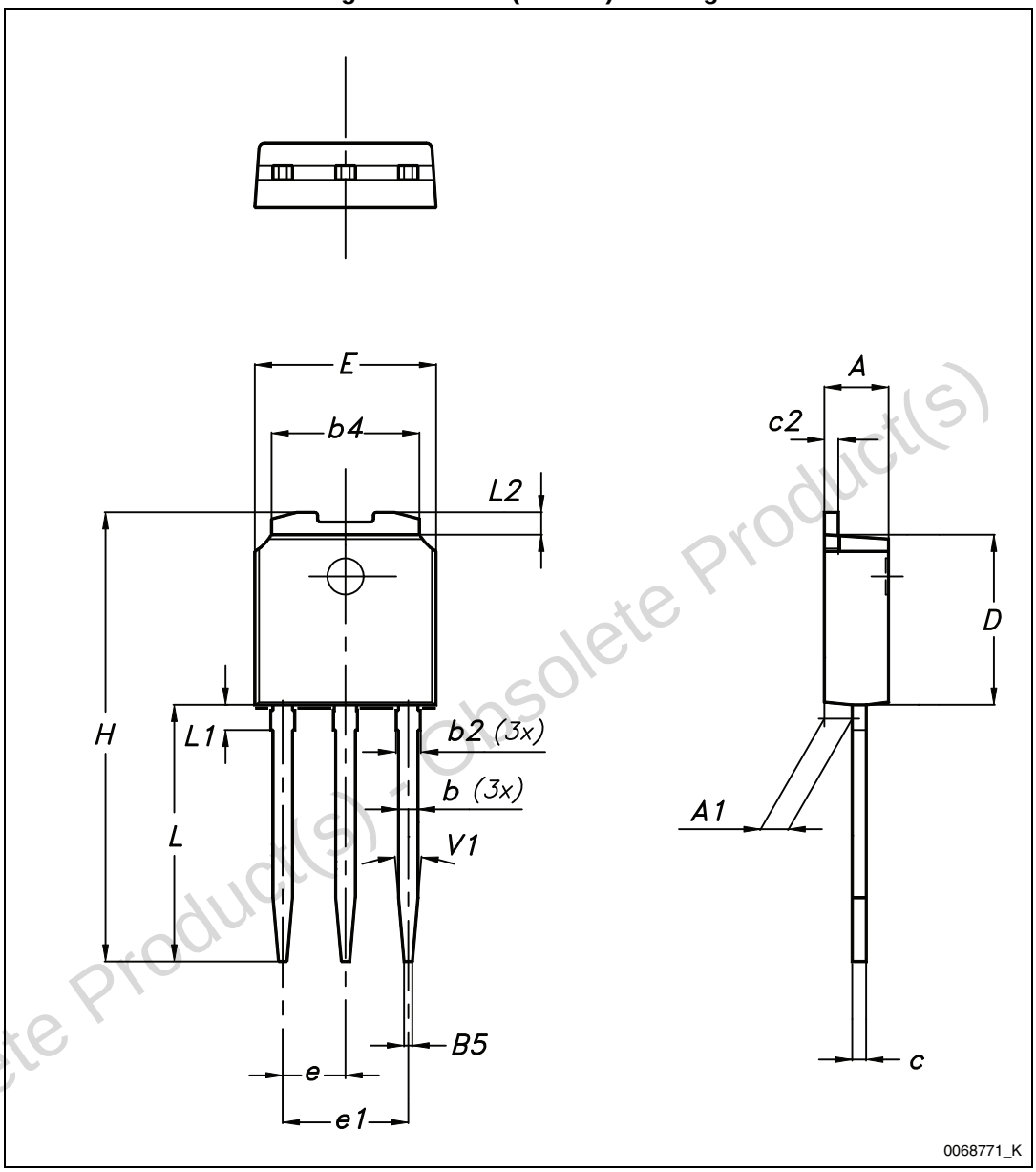
a. All dimensions are in millimeters

Table 11. IPAK (TO-251) 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
B5		0.30	
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	1.00
V1		10°	

Obsolete Product(s) - Obsolete Product(s)

Figure 23. IPAK (TO-251) drawing



Obsolete Product(s) - Obsolete Product(s)

5 Packaging mechanical data

Table 12. 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			

Obsolete Product(s) - Obsolete Product(s)

Figure 24. Tape for DPAK (TO-252)

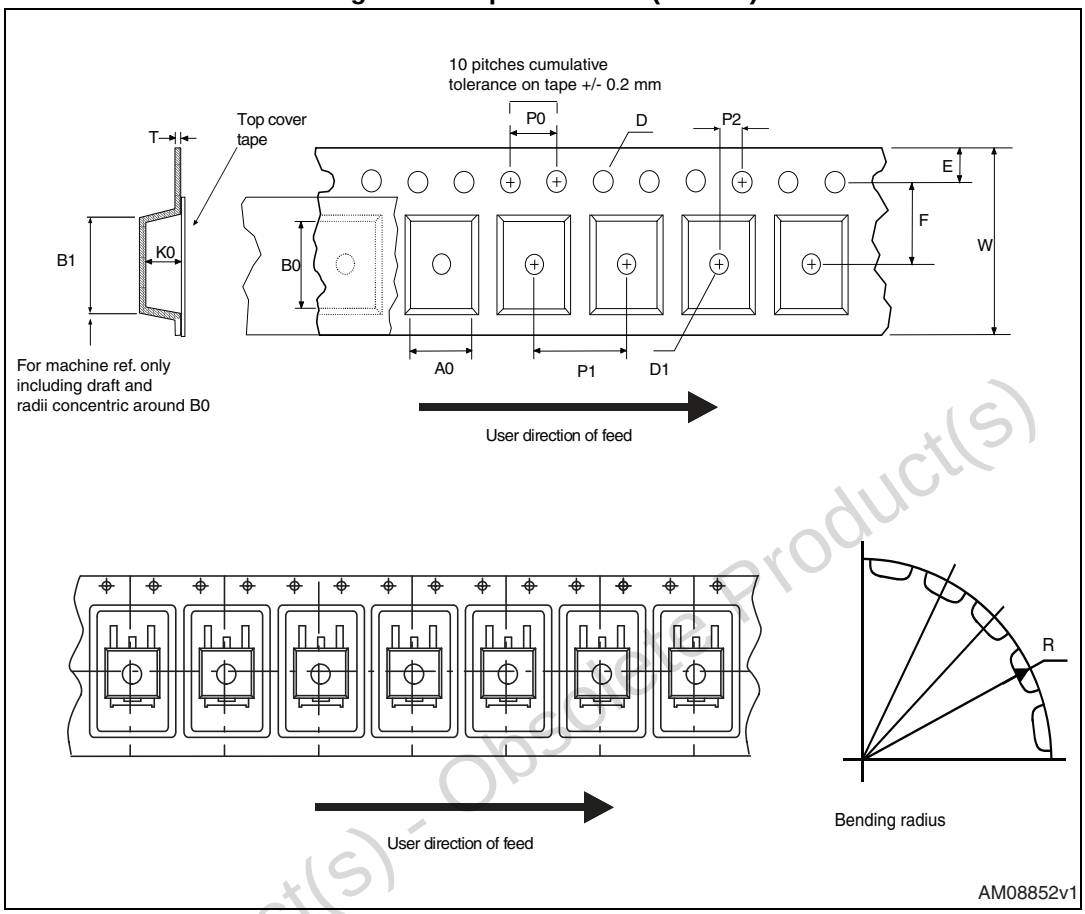
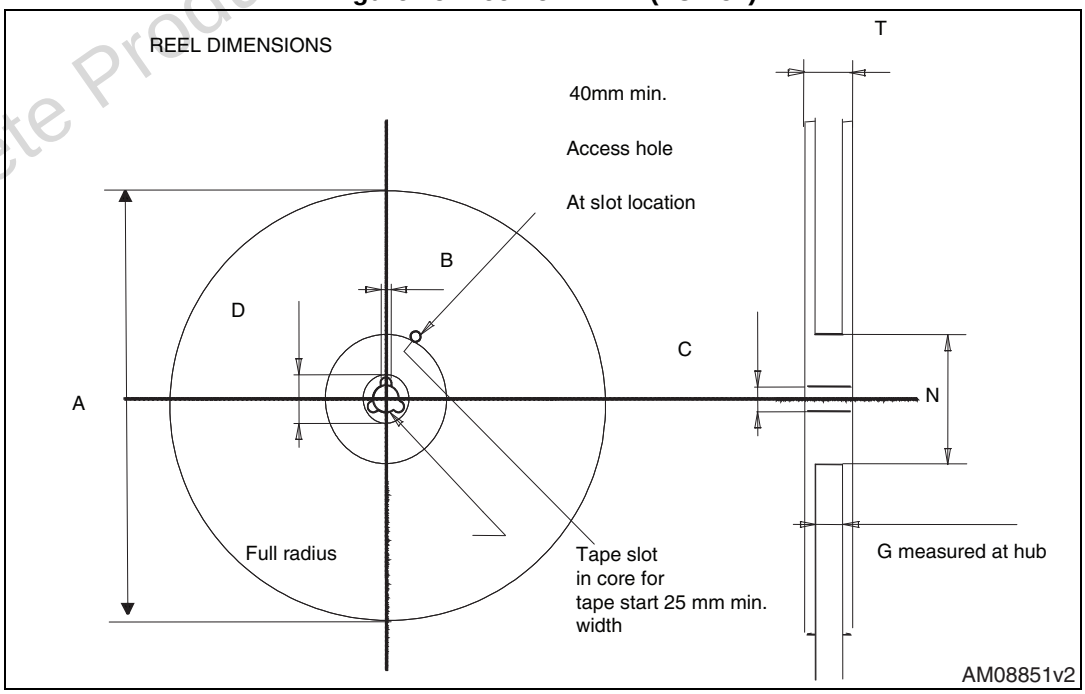


Figure 25. Reel for DPAK (TO-252)



Obsolete Product(s) - Obsolete Product(s)

6 Revision history

Table 13. Document revision history

Date	Revision	Changes
21-Mar-2013	1	First release.

Obsolete Product(s) - Obsolete Product(s)

Obsolete Product(s) - Obsolete Product(s)

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