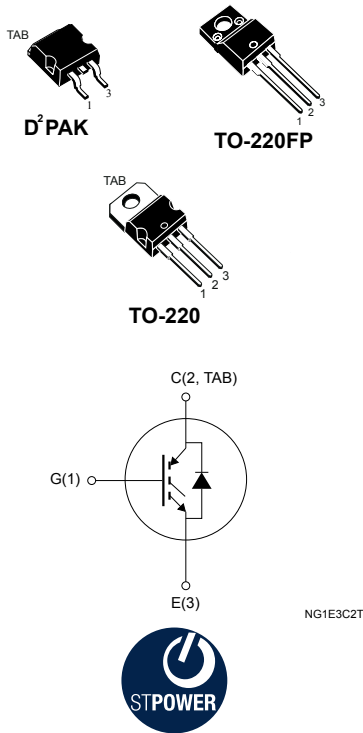




STGB14NC60KDT4, STGF14NC60KD, STGP14NC60KD

Datasheet

14 A, 600 V short-circuit rugged IGBT



Features

- Low on voltage drop ($V_{CE(sat)}$)
- Low C_{res} / C_{ies} ratio (no cross-conduction susceptibility)
- Very soft ultra-fast recovery antiparallel diode
- Short-circuit withstand time 10 μs

Applications

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

Description

These devices are very fast IGBTs developed using advanced PowerMESH technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. These devices are well-suited for resonant or soft-switching applications.

Product status links

[STGB14NC60KDT4](#)

[STGF14NC60KD](#)

[STGP14NC60KD](#)

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK, TO-220	TO-220FP	
V _{CES}	Collector-emitter voltage (V _{GE} = 0 V)	600		V
I _C ⁽¹⁾	Continuous collector current at T _C = 25 °C	25	11	A
	Continuous collector current at T _C = 100 °C	14	7	
I _{CL} ⁽²⁾	Turn-off latching current	50		A
I _{CP} ⁽³⁾	Pulsed collector current	50		A
V _{GE}	Gate-emitter voltage	±20		V
I _F	Diode RMS forward current at T _C = 25 °C	20		A
I _{FSM}	Surge non repetitive forward current t _p = 10 ms sinusoidal	55		A
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, T _C = 25 °C)		2.5	kV
t _{scw}	Short-circuit withstand time V _{CE} = 300 V, T _J = 125 °C, R _G = 10 Ω, V _{GE} = 12 V	10		µs
P _{TOT}	Total power dissipation at T _C = 25 °C	80	28	W
T _{stg}	Storage temperature range	-55 to 150		°C
T _J	Operating junction temperature range			°C

1. Calculated according to the iterative formula: $I_C(T_C) = \frac{T_{J(max)} - T_C}{R_{thJC} \times V_{CE(sat)(max)}(T_{J(max)}, I_C(T_C))}$
2. V_{clamp} = 80% V_{CES}, T_J = 150 °C, R_G = 10 Ω, V_{GE} = 15 V.
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA.

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		D ² PAK, TO-220	TO-220FP	
R _{thJC}	Thermal resistance, junction-to-case IGBT	1.56	4.5	°C/W
	Thermal resistance, junction-to-case diode	2.2	5.6	
R _{thJA}	Thermal resistance, junction-to-ambient	62.5		°C/W

2 Electrical characteristics

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

Table 3. Static

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	$V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$		2.1	2.5	V
		$V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$, $T_J = 125\text{ °C}$		1.8		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	4.5		6.5	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$			0.15	mA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 125\text{ °C}$ ⁽¹⁾			1	
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 100	nA
g_{fs} ⁽²⁾	Forward transconductance	$V_{CE} = 15\text{ V}$, $I_C = 7\text{ A}$		3.2		S

1. Specified by design, not tested in production.

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	760	-	pF
C_{oes}	Output capacitance		-	86	-	pF
C_{res}	Reverse transfer capacitance		-	15.5	-	pF
Q_g	Total gate charge	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 19. Gate charge test circuit)	-	34.4	-	nC
Q_{ge}	Gate-emitter charge		-	8.1	-	nC
Q_{gc}	Gate-collector charge		-	16.4	-	nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 17. Test circuit for inductive load switching and Figure 20. Switching waveform)	-	22.5	-	ns
t_r	Current rise time		-	8.5	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	700	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 17. Test circuit for inductive load switching and Figure 20. Switching waveform)	-	22	-	ns
t_r	Current rise time		-	9.5	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	680	-	A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 17. Test circuit for inductive load switching and Figure 20. Switching waveform)	-	60	-	ns
$t_{d(off)}$	Turn-off delay time		-	116	-	ns
t_f	Current fall time		-	75	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 17. Test circuit for inductive load switching and Figure 20. Switching waveform)	-	24	-	ns
$t_{d(off)}$	Turn-off delay time		-	196	-	ns
t_f	Current fall time		-	144	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 7\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 17. Test circuit for inductive load switching)	-	82	-	μ J
$E_{off}^{(2)}$	Turn-off switching energy		-	155	-	μ J
E_{ts}	Total switching energy		-	237	-	μ J
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 7\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 17. Test circuit for inductive load switching)	-	131	-	μ J
$E_{off}^{(2)}$	Turn-off switching energy		-	370	-	μ J
E_{ts}	Total switching energy		-	501	-	μ J

1. Including the reverse recovery of the diode.

2. Including the tail of the collector current.

Table 7. Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 7\text{ A}$	-	1.8	2.1	V
		$I_F = 7\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$	-	1.3		
t_{rr}	Reverse recovery time	$I_F = 5\text{ A}$, $V_R = 40\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 18. Diode reverse recovery waveform)	-	37		ns
Q_{rr}	Reverse recovery charge		-	40		nC
I_{rrm}	Reverse recovery current		-	2.1		A
t_{rr}	Reverse recovery time	$I_F = 7\text{ A}$, $V_R = 40\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 18. Diode reverse recovery waveform)	-	61		ns
Q_{rr}	Reverse recovery charge		-	98		nC
I_{rr}	Reverse recovery current		-	3.2		A

2.1 Electrical characteristics (curves)

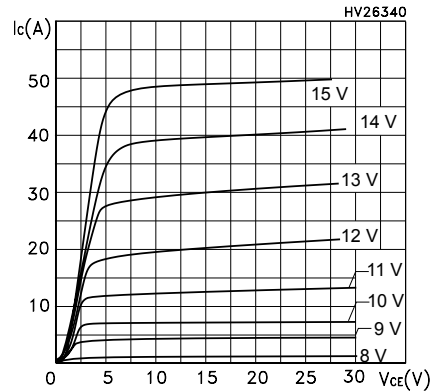
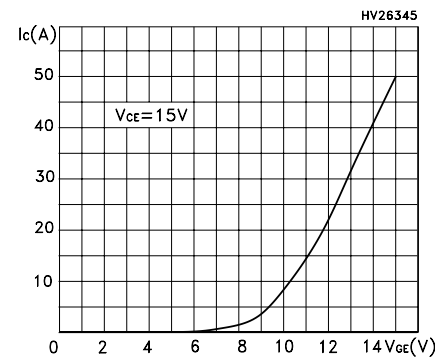
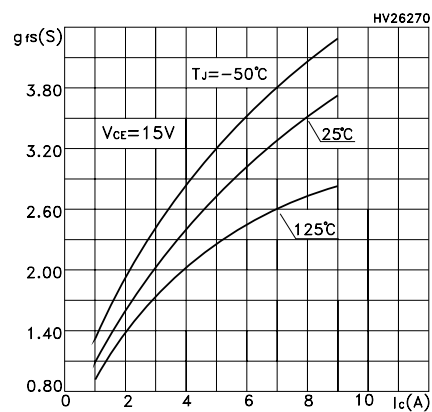
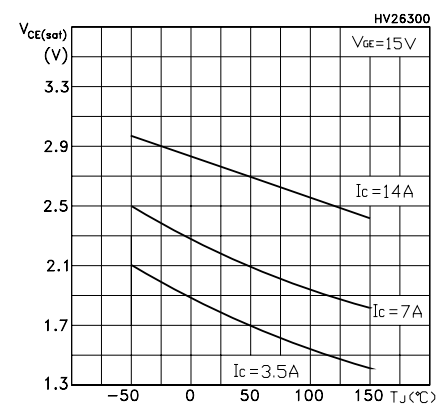
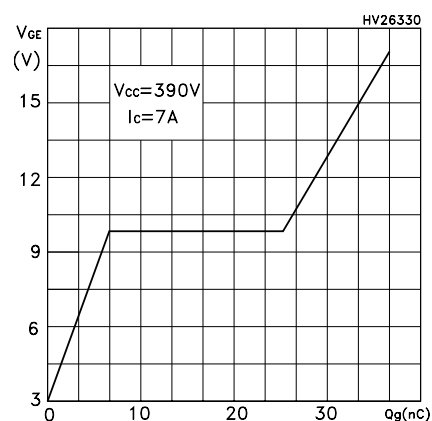
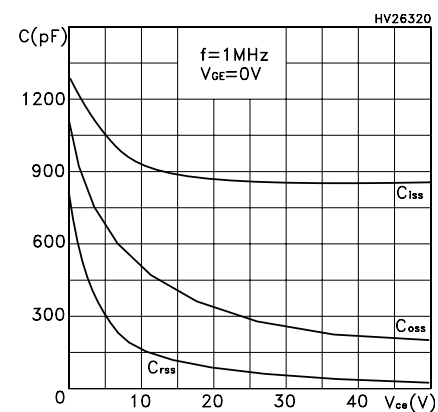
Figure 1. Typical output characteristics

Figure 2. Typical transfer characteristics

Figure 3. Typical transconductance characteristics

Figure 4. Typical collector-emitter on voltage vs temperature

Figure 5. Typical gate charge characteristics

Figure 6. Typical capacitance characteristics


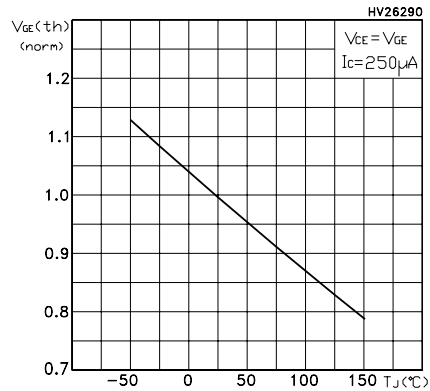
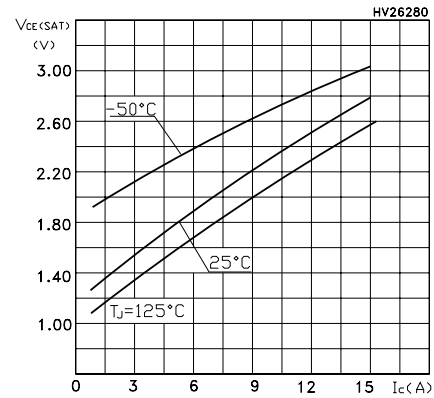
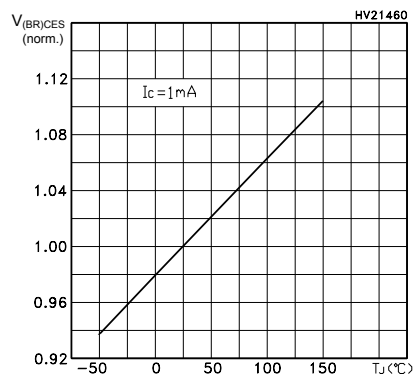
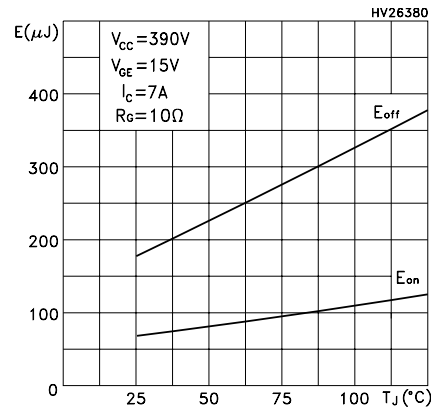
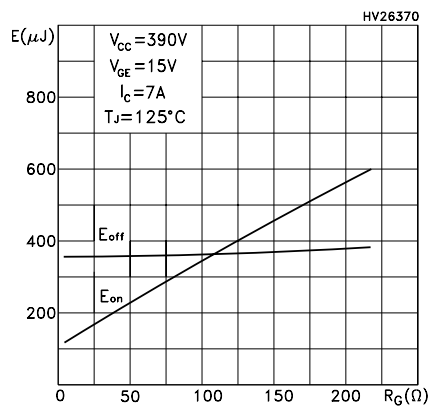
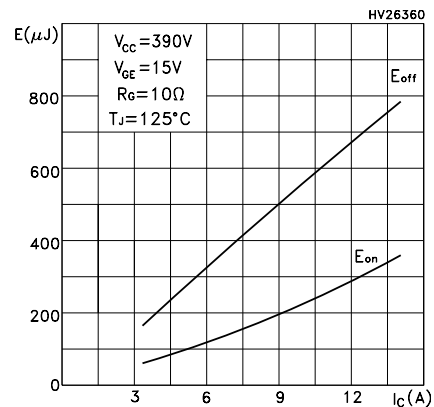
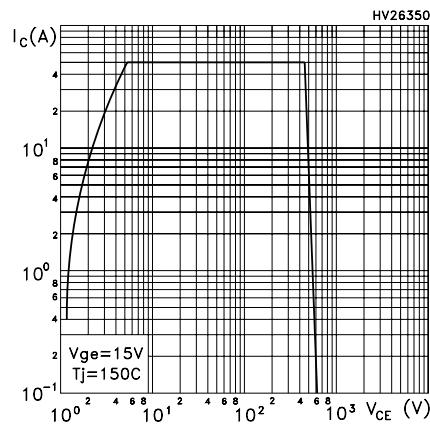
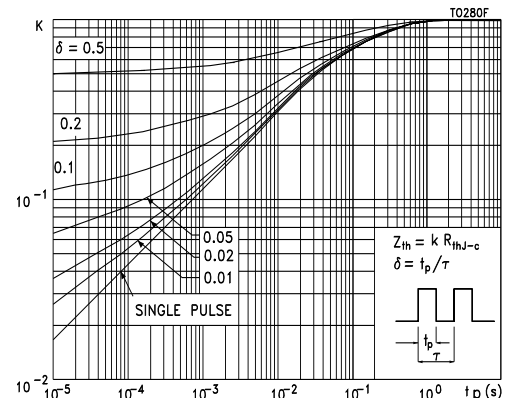
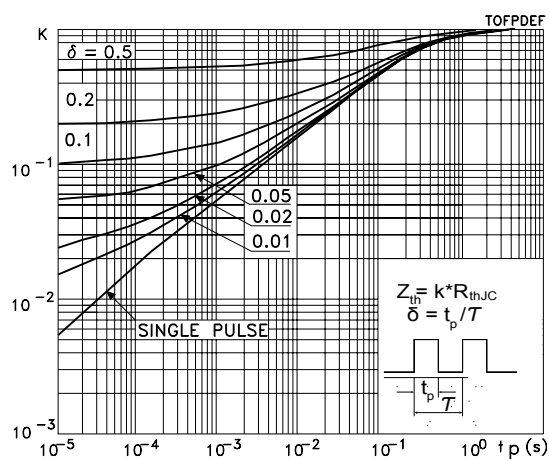
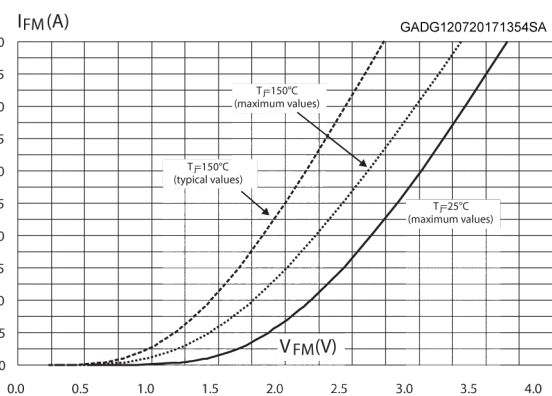
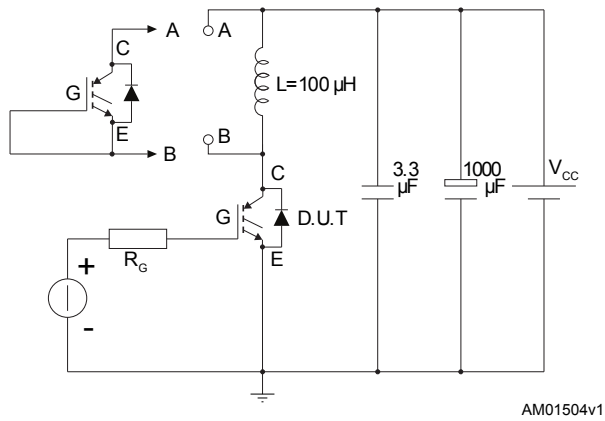
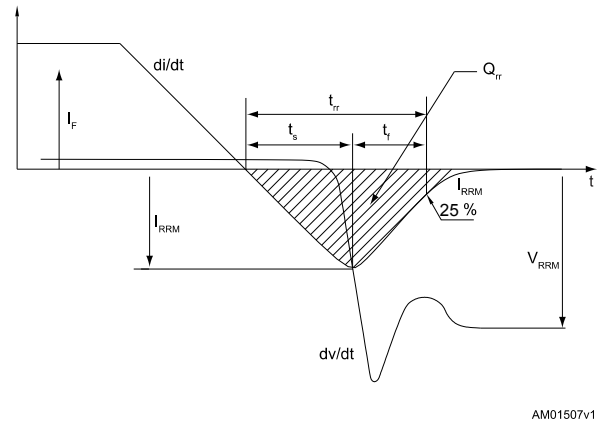
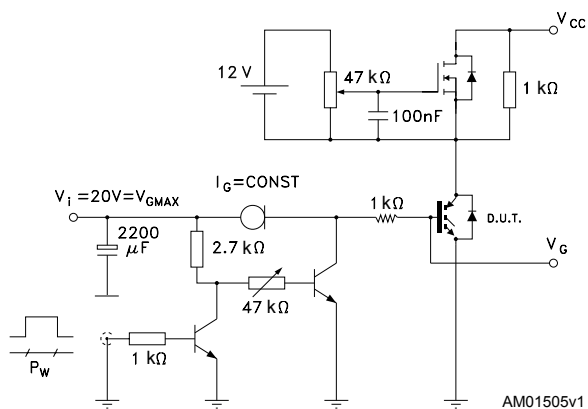
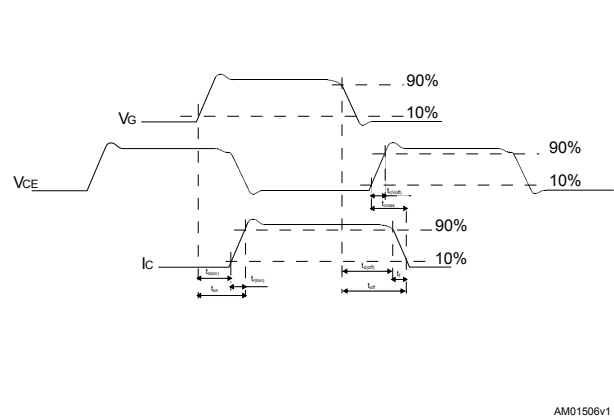
Figure 7. Normalized gate threshold vs temperature

Figure 8. Typical collector-emitter on voltage vs collector current

Figure 9. Normalized breakdown voltage vs temperature

Figure 10. Typical switching energy vs temperature

Figure 11. Typical switching energy vs gate resistance

Figure 12. Typical switching energy vs collector current


Figure 13. Reverse bias safe operating area

Figure 14. Normalized transient thermal impedance for D²PAK and TO-220

Figure 15. Normalized transient thermal impedance for TO-220FP

Figure 16. Typical emitter-collector diode characteristics


3 Test circuits

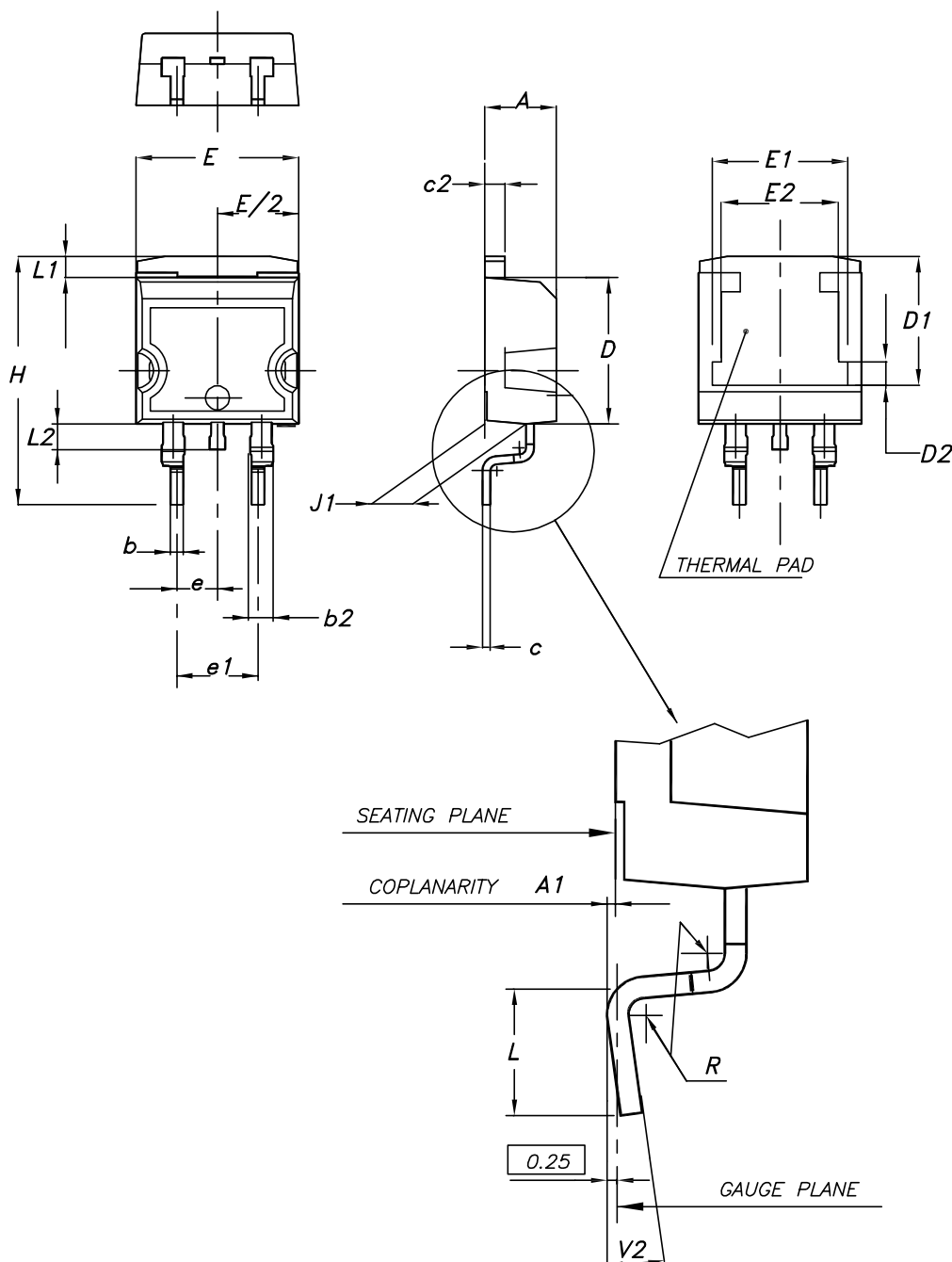
Figure 17. Test circuit for inductive load switching

Figure 18. Diode reverse recovery waveform

Figure 19. Gate charge test circuit

Figure 20. Switching waveform


4 Package information

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 D²PAK (TO-263) type A package information

Figure 21. D²PAK (TO-263) type A package outline



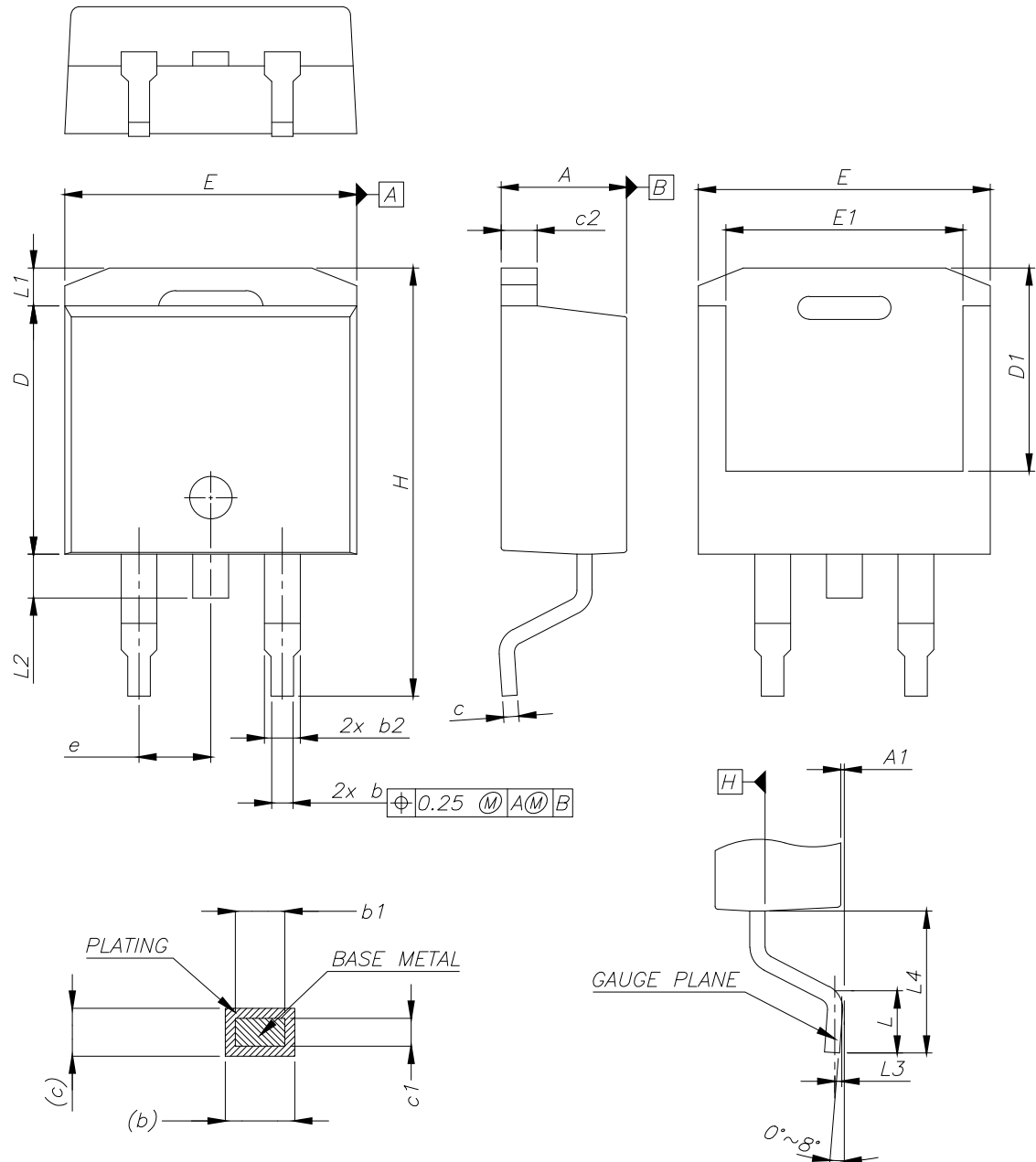
0079457_27

Table 8. D²PAK (TO-263) type A package 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	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

4.2 D²PAK (TO-263) type B package information

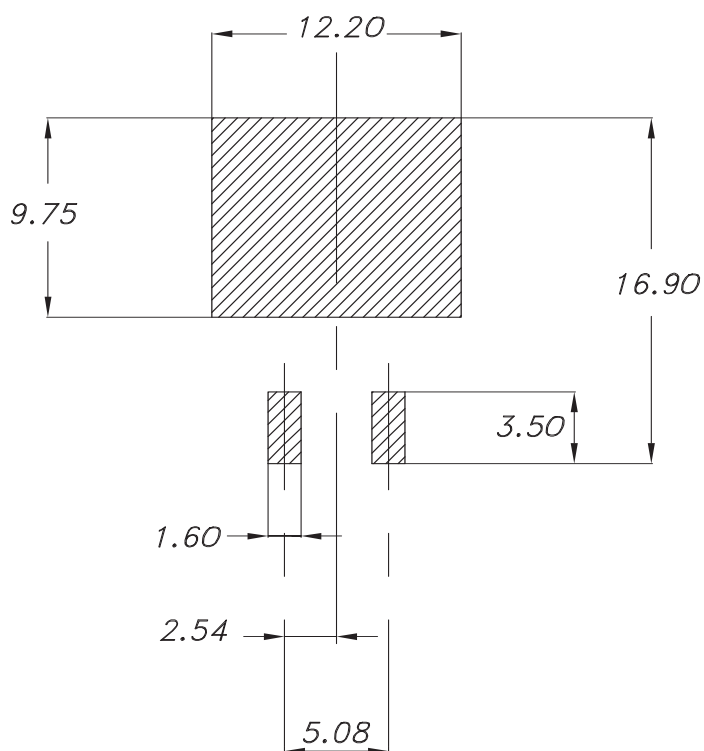
Figure 22. D²PAK (TO-263) type B package outline



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Table 9. D²PAK (TO-263) type B mechanical data

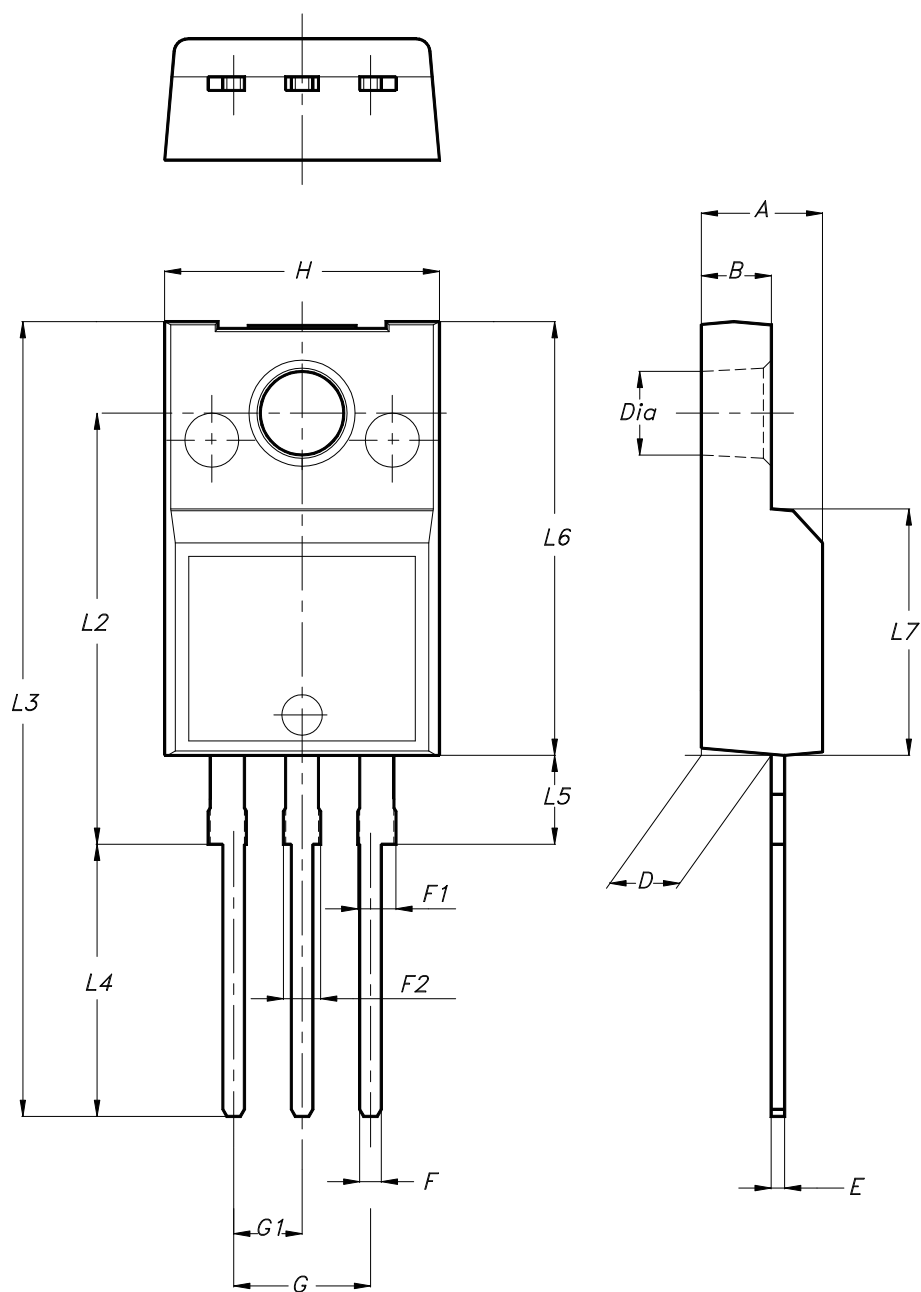
Dim.	mm		
	Min.	Typ.	Max.
A	4.36		4.56
A1	0.00		0.25
b	0.70		0.90
b1	0.51		0.89
b2	1.17		1.37
c	0.38		0.694
c1	0.38		0.534
c2	1.19		1.34
D	8.60		9.00
D1	6.90		7.50
E	10.15		10.55
E1	8.10		8.70
e	2.54 BSC		
H	15.00		15.60
L	1.90		2.50
L1			1.65
L2			1.78
L3		0.25	
L4	4.78		5.28

Figure 23. D²PAK (TO-263) recommended footprint (dimensions are in mm)


0079457_Rev27_footprint

4.3 TO-220FP type B package information

Figure 24. TO-220FP type B package outline



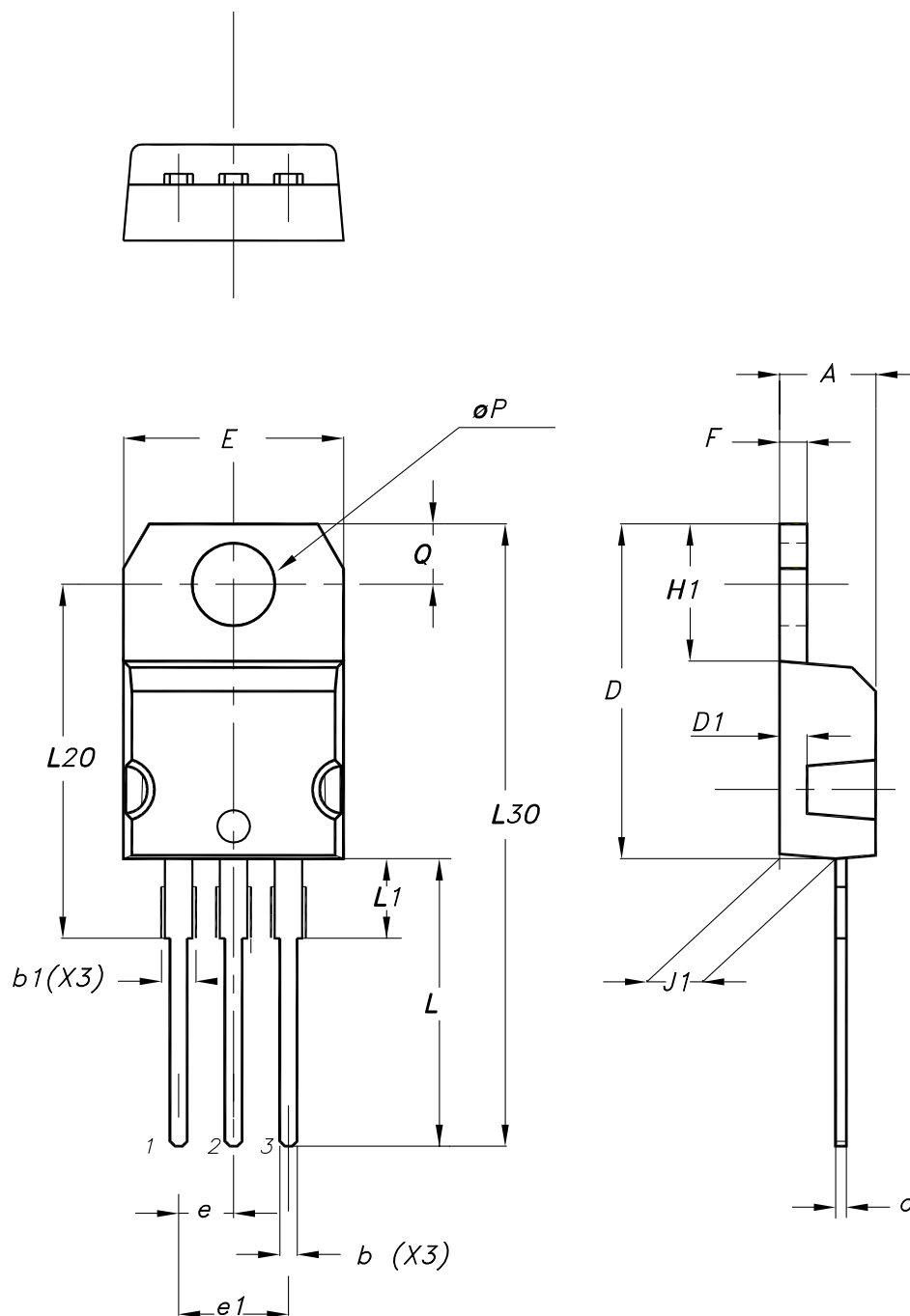
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Table 10. TO-220FP type B package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

4.4 TO-220 type A package information

Figure 25. TO-220 type A package outline



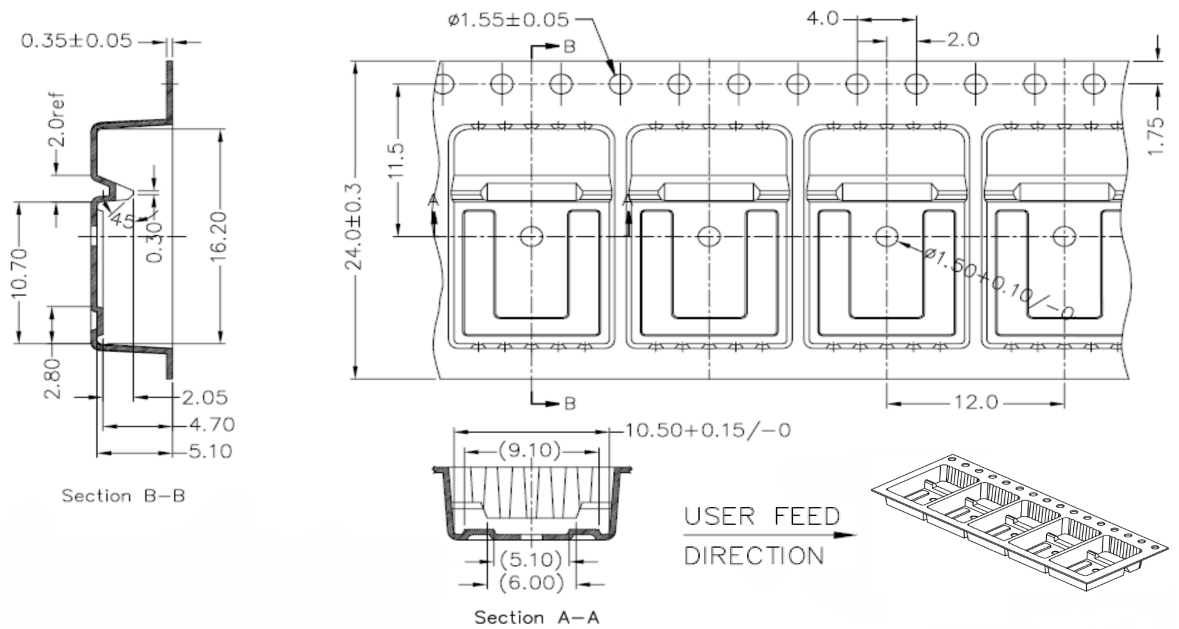
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Table 11. TO-220 type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

4.5 D²PAK packing information

Figure 26. D²PAK tape drawing (dimensions are in mm)



DM01095771_1



5 Ordering information

Table 12. Order codes

Order codes	Marking	Package	Packing
STGB14NC60KDT4	GB14NC60KD	D ² PAK	Tape and reel
STGF14NC60KD	GF14NC60KD	TO-220FP	Tube
STGP14NC60KD	GP14NC60KD	TO-220	

Revision history

Table 13. Document revision history

Date	Revision	Changes
14-Jun-2005	1	New release
05-Jul-2005	2	Complete version
22-Jul-2005	3	Value changed in table 6
27-Jan-2006	4	Inserted ecopack indication
28-Apr-2006	5	New template, modified curves 6 and 8
02-Apr-2008	6	Modified test conditions on Table 4
15-Mar-2010	7	Updated packages mechanical data.
12-Jul-2017	8	Modified <i>Table 6: "Switching on/off (inductive load)"</i> , <i>Table 7: "Switching energy (inductive load)"</i> and <i>Table 8: "Collector-emitter diode"</i> . Updated <i>Section 4: "Package information"</i> .
14-May-2025	9	Updated Section 4: Package information .



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