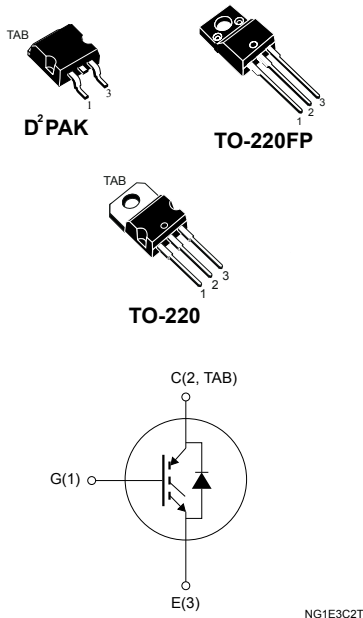




STGB19NC60KDT4, STGF19NC60KD, STGP19NC60KD

Datasheet

20 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
- IGBT co-packaged with ultra-fast freewheeling diode

Applications

- High frequency inverters
- 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.



Product status links

[STGB19NC60KDT4](#)

[STGF19NC60KD](#)

[STGP19NC60KD](#)

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	35	16	A
	Continuous collector current at T _C = 100 °C	20	10	
I _{CL} ⁽²⁾	Turn-off latching current	75		A
I _{CP} ⁽³⁾	Pulsed collector current	75		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	50		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	125	32	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	1.0	3.9	°C/W
	Thermal resistance, junction-to-case diode	3.0	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 characteristics

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	$V_{GE} = 15\text{ V}$, $I_C = 12\text{ A}$		2.0	2.75	V
		$V_{GE} = 15\text{ V}$, $I_C = 12\text{ A}$, $T_J = 125\text{ °C}$		1.65		
$V_{GE(th)}$	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

1. Specified by design, not tested in production.

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	1170	-	pF
C_{oes}	Output capacitance		-	127	-	pF
C_{res}	Reverse transfer capacitance		-	28	-	pF
Q_g	Total gate charge	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 18. Gate charge test circuit)	-	55	-	nC
Q_{ge}	Gate-emitter charge		-	11	-	nC
Q_{gc}	Gate-collector charge		-	26	-	nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	30	-	ns
t_r	Current rise time		-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1450	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	30	-	ns
t_r	Current rise time		-	8	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1380	-	A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	35	-	ns
$t_{d(off)}$	Turn-off delay time		-	105	-	ns
t_f	Current fall time		-	85	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	65	-	ns
$t_{d(off)}$	Turn-off delay time		-	145	-	ns
t_f	Current fall time		-	125	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 16. Test circuit for inductive load switching)	-	165	-	μ J
$E_{off}^{(2)}$	Turn-off switching energy		-	255	-	μ J
E_{ts}	Total switching energy		-	420	-	μ J
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching)	-	250	-	μ J
$E_{off}^{(2)}$	Turn-off switching energy		-	445	-	μ J
E_{ts}	Total switching energy		-	695	-	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	$I_F = 12\text{ A}$	-	1.9	-	V
		$I_F = 12\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$	-	1.6	-	
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}$, $V_R = 40\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 17. Diode reverse recovery waveform)	-	31	-	ns
Q_{rr}	Reverse recovery charge		-	30	-	nC
I_{rrm}	Reverse recovery current		-	2.0	-	A
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}$, $V_R = 40\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 17. Diode reverse recovery waveform)	-	50	-	ns
Q_{rr}	Reverse recovery charge		-	70	-	nC
I_{rr}	Reverse recovery current		-	4	-	A

2.1 Electrical characteristics (curves)

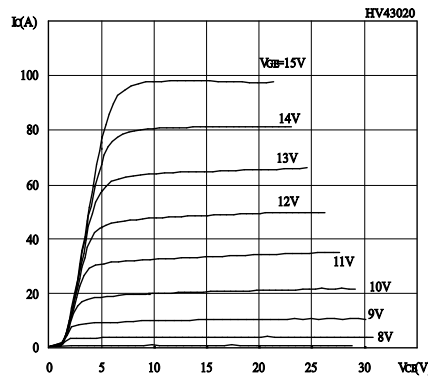
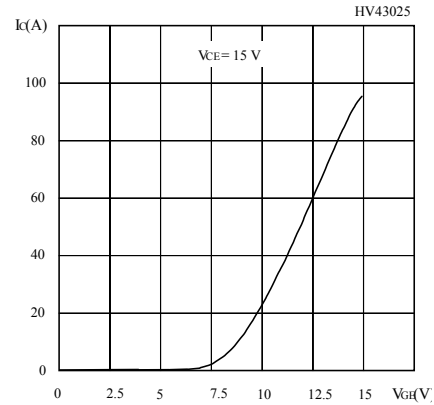
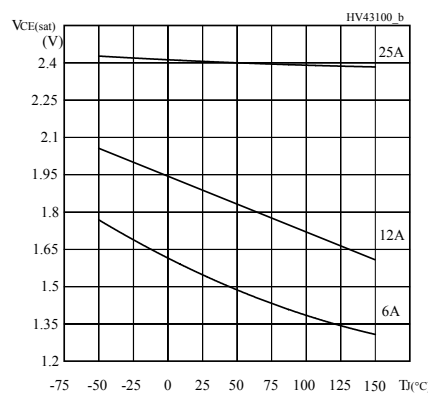
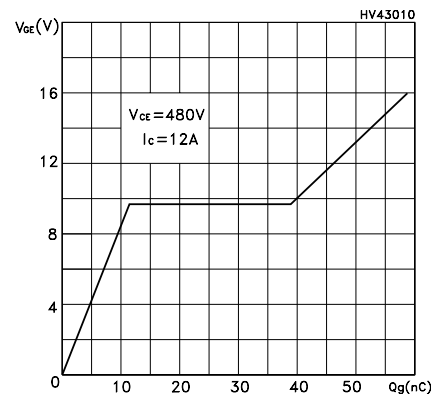
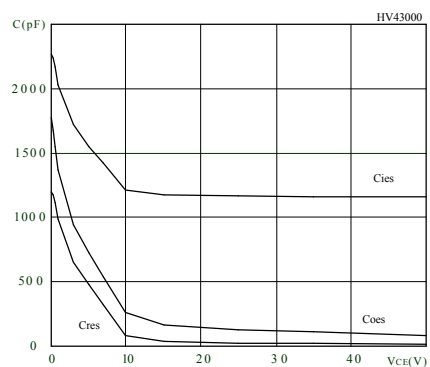
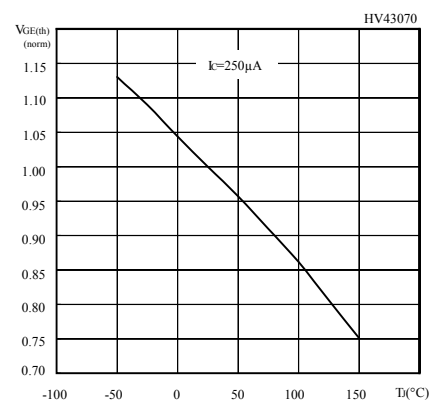
Figure 1. Typical output characteristics

Figure 2. Typical transfer characteristics

Figure 3. Typical collector-emitter on voltage vs temperature

Figure 4. Typical gate charge characteristics

Figure 5. Typical capacitance characteristics

Figure 6. Normalized gate threshold vs temperature


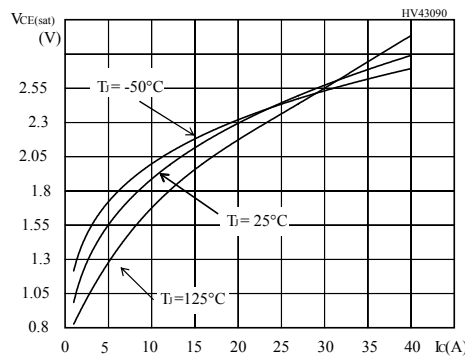
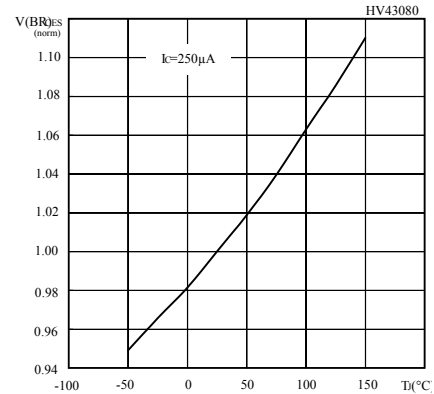
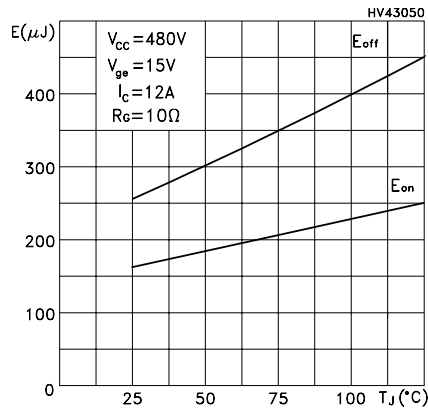
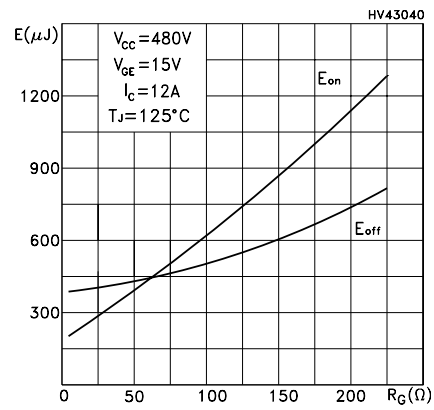
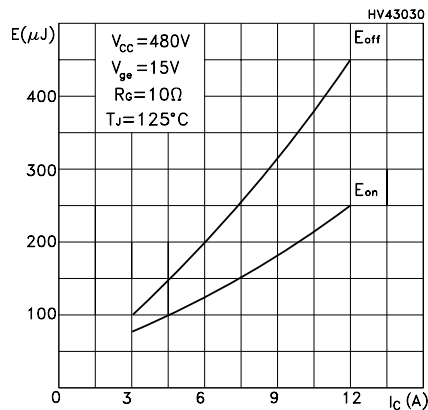
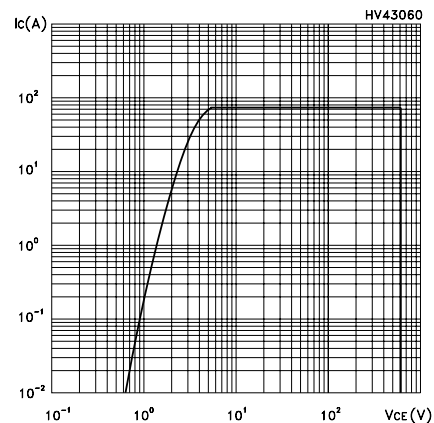
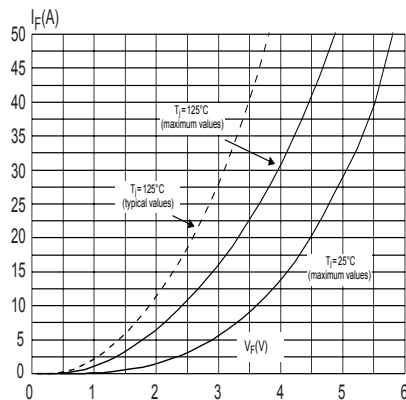
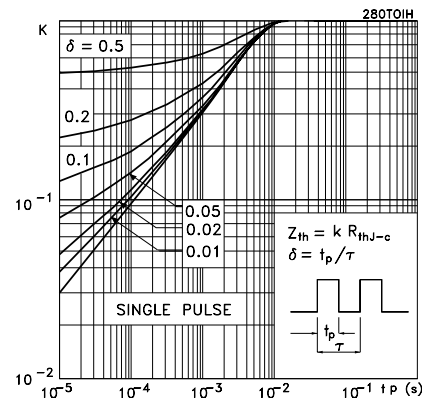
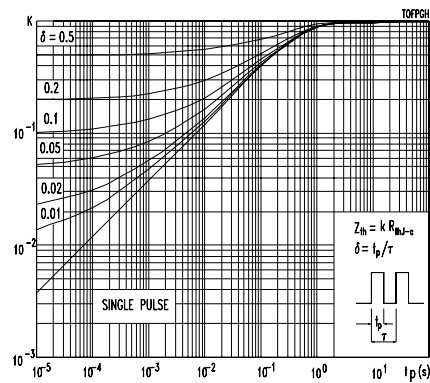
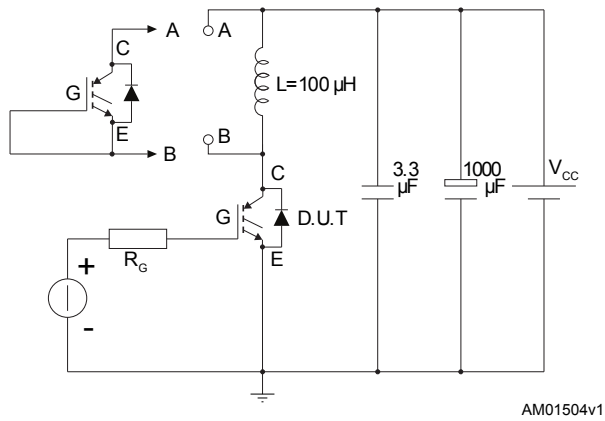
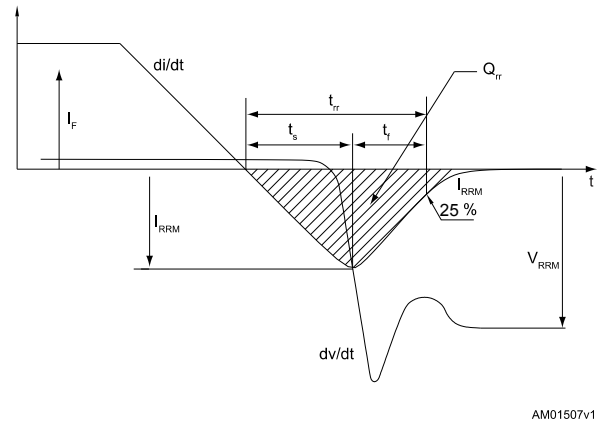
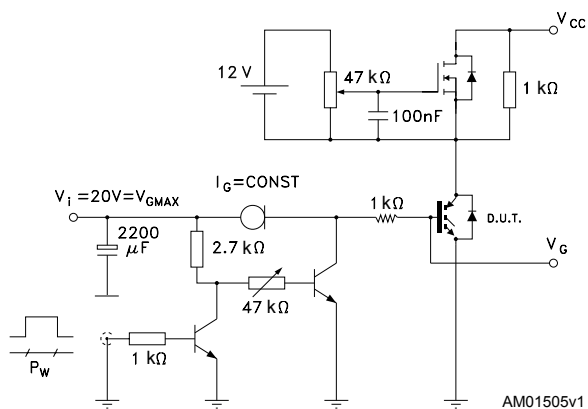
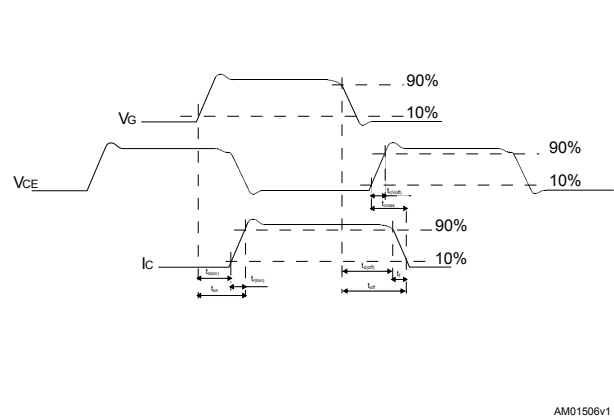
Figure 7. Typical collector-emitter on voltage vs collector current

Figure 8. Normalized breakdown voltage vs temperature

Figure 9. Typical switching energy vs temperature

Figure 10. Typical switching energy vs gate resistance

Figure 11. Typical switching energy vs collector current

Figure 12. Turn-off SOA


Figure 13. Emitter-collector diode characteristics

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

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


3 Test circuits

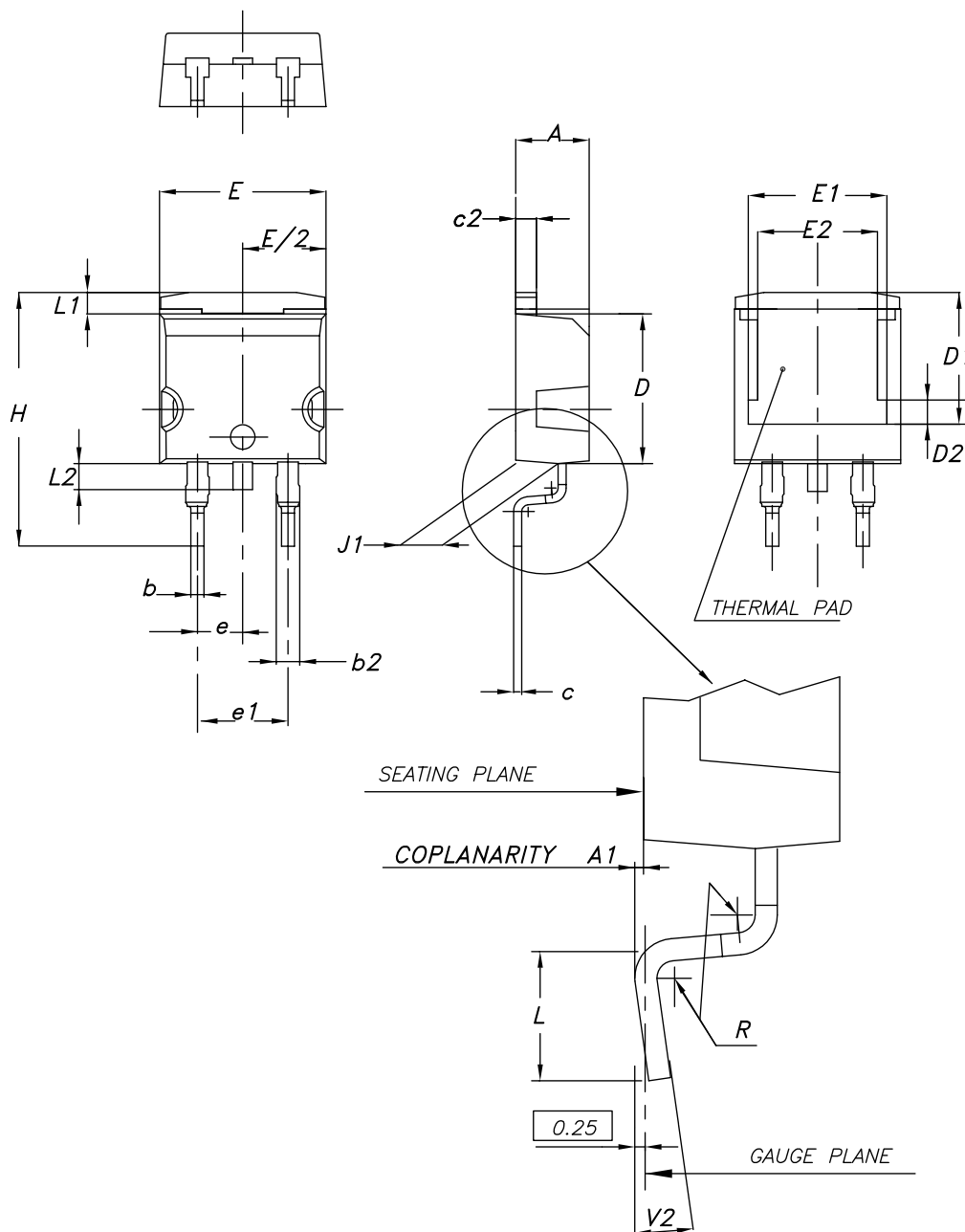
Figure 16. Test circuit for inductive load switching

Figure 17. Diode reverse recovery waveform

Figure 18. Gate charge test circuit

Figure 19. 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 A2 package information

Figure 20. D²PAK (TO-263) type A2 package outline



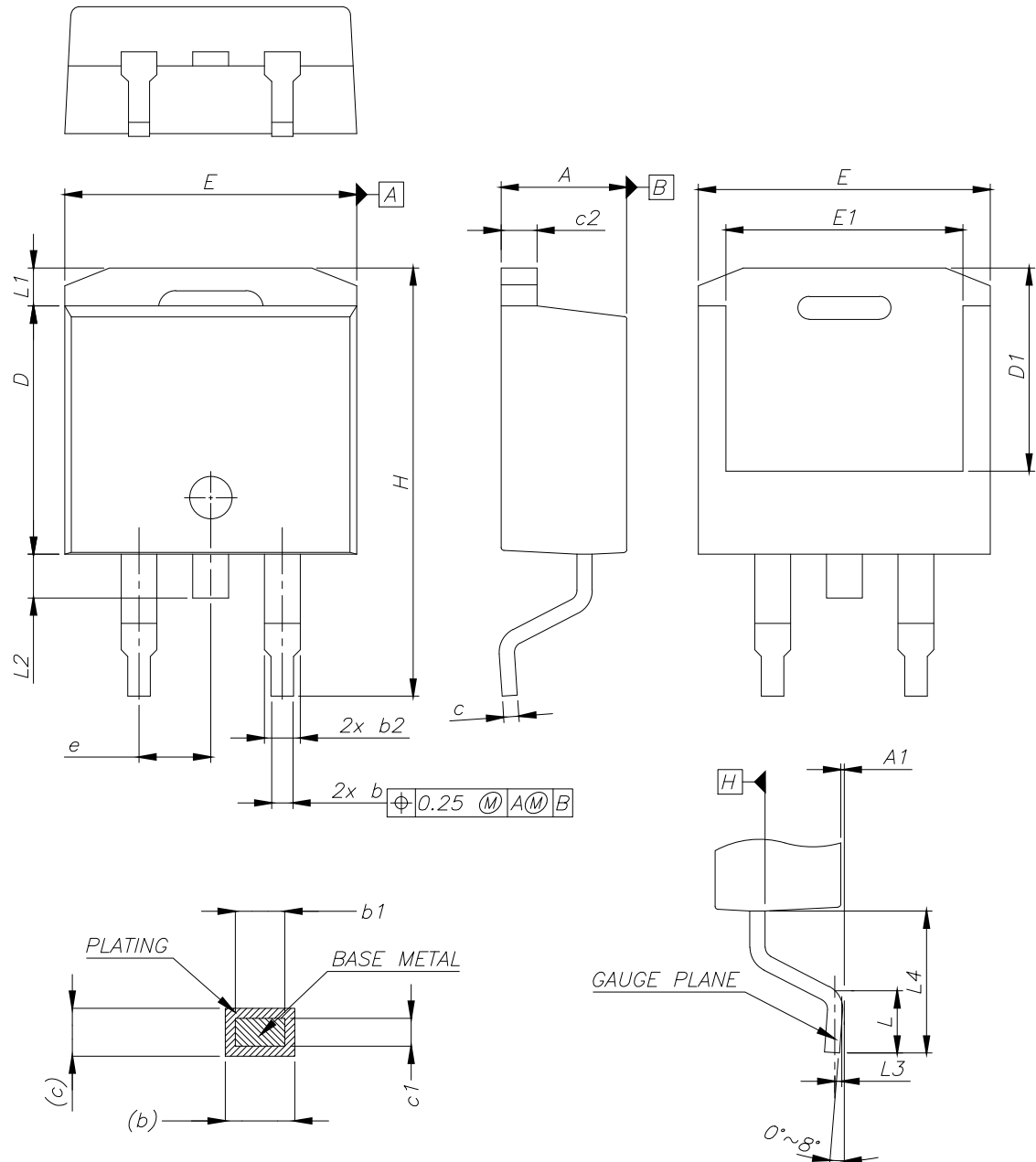
0079457_A2_27

Table 8. D²PAK (TO-263) type A2 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	8.70	8.90	9.10
E2	7.30	7.50	7.70
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

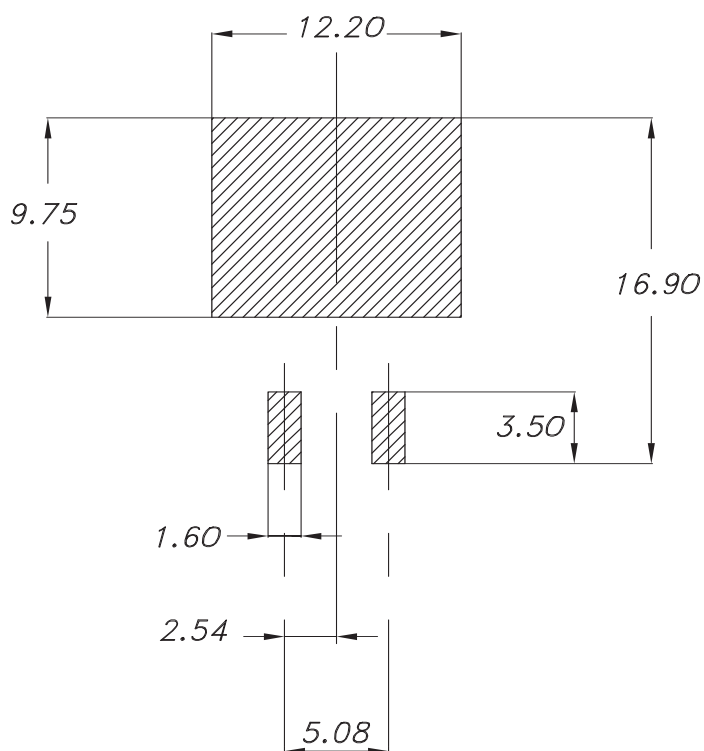
Figure 21. D²PAK (TO-263) type B package outline



0079457_27_B

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

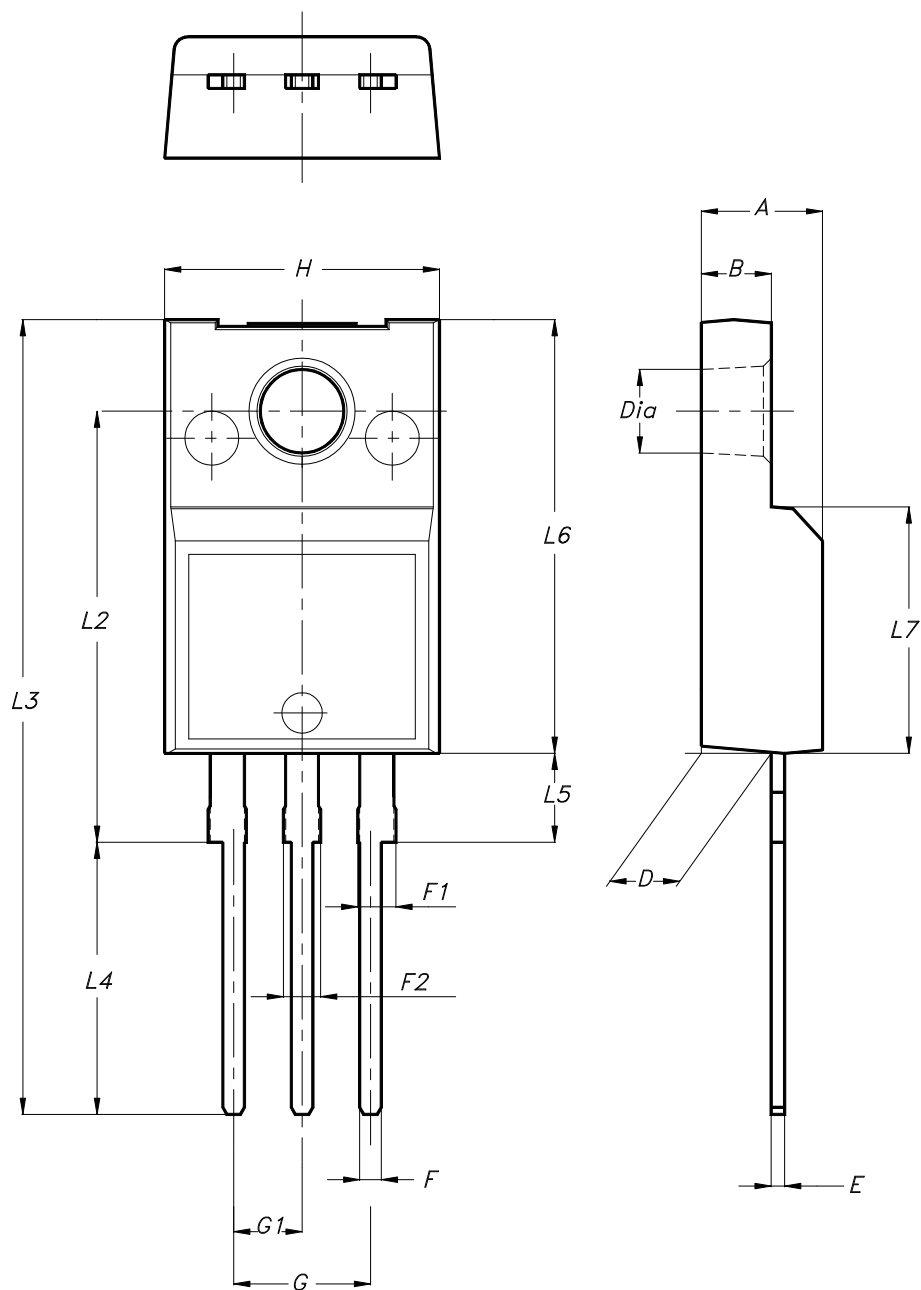
Dim.	mm		
	Min.	Typ.	Max.
A	4.36		4.56
A1	0.00		0.25
b	0.70		0.90
b1	0.51		0.89
b2	1.17		1.37
c	0.38		0.694
c1	0.38		0.534
c2	1.19		1.34
D	8.60		9.00
D1	6.90		7.50
E	10.15		10.55
E1	8.10		8.70
e	2.54 BSC		
H	15.00		15.60
L	1.90		2.50
L1			1.65
L2			1.78
L3		0.25	
L4	4.78		5.28

Figure 22. D²PAK (TO-263) recommended footprint (dimensions are in mm)


0079457_Rev27_footprint

4.3 TO-220FP type B package information

Figure 23. TO-220FP type B package outline



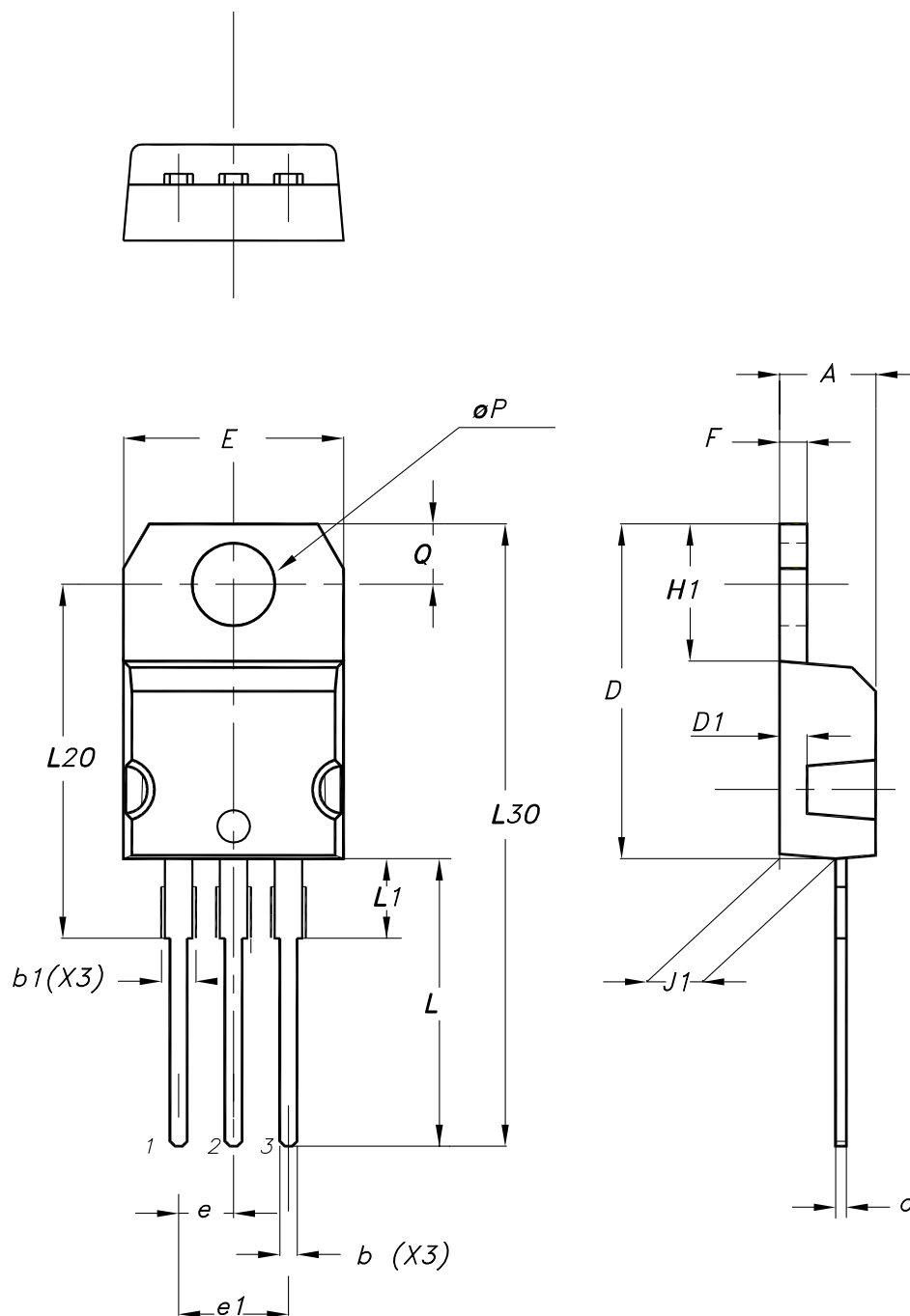
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Table 10. TO-220FP type B package mechanical data

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 24. TO-220 type A package outline



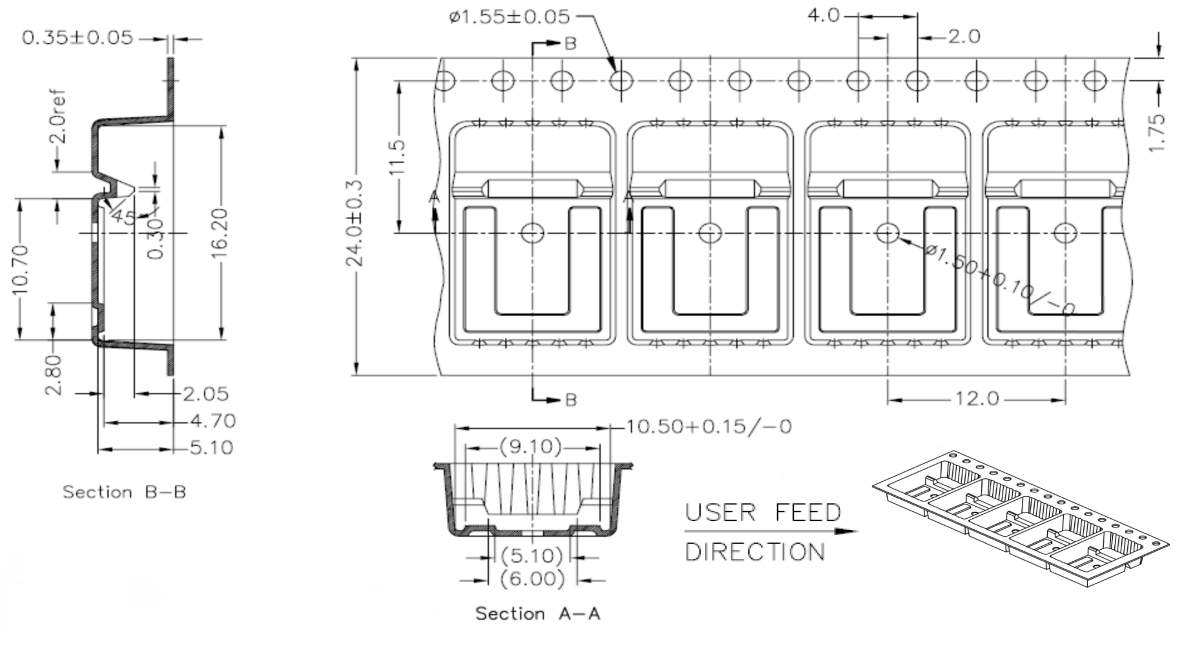
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Table 11. TO-220 type A package mechanical data

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 25. D²PAK tape drawing (dimensions are in mm)



0079900_14

Revision history

Table 12. Document revision history

Date	Revision	Changes
08-May-2008	1	Initial release
28-May-2008	2	– Value on Table 3: Thermal resistance has been changed. – Inserted Figure 16: Thermal impedance for TO-220, D ² PAK and Figure 17: Thermal impedance for TO-220FP
31-Jul-2012	3	Added: <i>Figure 18</i> and <i>Figure 19</i> on page 8.
17-Jul-2017	4	Modified internal schematic diagram on cover page. Modified <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 3: "Thermal data"</i> , and <i>Table 4: "Static characteristics"</i> . Modified <i>Figure 3: "Transfer characteristics"</i> , <i>Figure 4: "Collectoremitter on voltage vs temperature"</i> and <i>Figure 8: "Collector-emitter on voltage vs collector current"</i> . Updated <i>Section 4: "Package information"</i> . Minor text changes.
13-Jun-2025	5	Updated Section 4: Package information . Minor text changes.



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