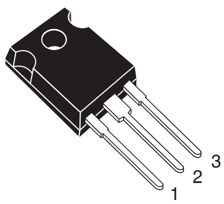
STGW35NC120HD

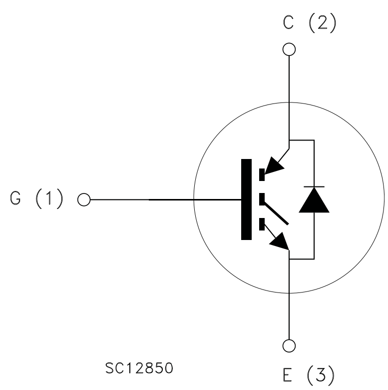
32 A, 1200 V very fast IGBT

Datasheet - production data



TO-247 long leads

Figure 1. Internal schematic diagram



Features

- Low on-losses
- Low on-voltage drop ($V_{CE(sat)}$)
- High current capability
- IGBT co-packaged with ultrafast free-wheeling diode
- Low gate charge
- Ideal for soft switching application

Application

- Induction heating
- High frequency inverters
- UPS

Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.

Table 1. Device summary

Order code	Marking	Package	Packaging
STGW35NC120HD	GW35NC120HD	TO-247 long leads	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	1200	V
I_C (1)	Continuous collector current at T_C = 25 °C	60	A
I_C (1)	Continuous collector current at T_C = 100 °C	32	A
I_{CL} (2)	Turn-off latching current	135	A
I_{CP} (3)	Pulsed collector current	135	A
V_{GE}	Gate-emitter voltage	±25	V
P_{TOT}	Total dissipation at T_C = 25 °C	235	W
I_F	Diode RMS forward current at T_C = 25 °C	30	A
I_{FSM}	Surge non repetitive forward current t_p = 10 ms sinusoidal	100	A
T_j	Operating junction temperature	–55 to 150	°C

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. Vclamp = 80% of V_{CES}, T_j =125 °C, R_G=10 Ω, V_{GE}=15 V
3. Pulse width limited by max. junction temperature allowed

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	0.53	°C/W
	Thermal resistance junction-case diode	1.5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

(T_j =25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C = 1 mA	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 20 A, V_{GE}= 15 V, I_C= 20 A, T_j =125 °C		2.2 2.0	2.75	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250μA	3.75		5.75	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} =1200 V V_{CE} =1200 V, T_j =125 °C			500 10	μA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} =± 20 V			± 100	nA
g_{fs} (1)	Forward transconductance	V_{CE} = 25 V, I_C= 20 A		14		S

1. Pulse duration = 300 μs, duty cycle 1.5%

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}=0	-	2510	-	pF
C_{oes}	Output capacitance		-	175	-	pF
C_{res}	Reverse transfer capacitance		-	30	-	pF
Q_g	Total gate charge	V_{CE} = 960 V, I_C= 20 A,V_{GE}=15 V	-	110	-	nC
Q_{ge}	Gate-emitter charge		-	16	-	nC
Q_{gc}	Gate-collector charge		-	49	-	nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, *Figure 17*	-	29	-	ns
t_r	Current rise time		-	11	-	ns
(di/dt)on	Turn-on current slope		-	1820	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, T_j =125 °C *Figure 17*	-	27	-	ns
t_r	Current rise time		-	14	-	ns
(di/dt)on	Turn-on current slope		-	1580	-	A/µs
$t_{r(Voff)}$	Off voltage rise time	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, *Figure 17*	-	90	-	ns
$t_{d(off)}$	Turn-off delay time		-	275	-	ns
t_f	Current fall time		-	312	-	ns
$t_{r(Voff)}$	Off voltage rise time	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, T_j =125 °C *Figure 17*	-	150	-	ns
$t_{d(off)}$	Turn-off delay time		-	336	-	ns
t_f	Current fall time		-	592	-	ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Eon (1)	Turn-on switching losses	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, *Figure 17*	-	1660	-	µJ
E_{off} (2)	Turn-off switching losses			4438		µJ
E_{ts}	Total switching losses			6098		µJ
Eon (1)	Turn-on switching losses	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, T_j =125 °C *Figure 17*	-	3015	-	µJ
E_{off} (2)	Turn-off switching losses		-	6900	-	µJ
E_{ts}	Total switching losses		-	9915	-	µJ

1. Eon is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature (25 °C and 125 °C)
2. Turn-off losses include also the tail of the collector current

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	I_F = 20 A I_F = 20 A, T_C = 125 °C	-	1.9 1.7	2.5	V V
t_{rr}	Reverse recovery time	I_F = 20 A, V_R = 27 V, T_j =125 °C, di/dt = 100 A/µs *Figure 20*	-	152	-	ns
Q_{rr}	Reverse recovery charge		-	722	-	nC
I_{rrm}	Reverse recovery current		-	9	-	A

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

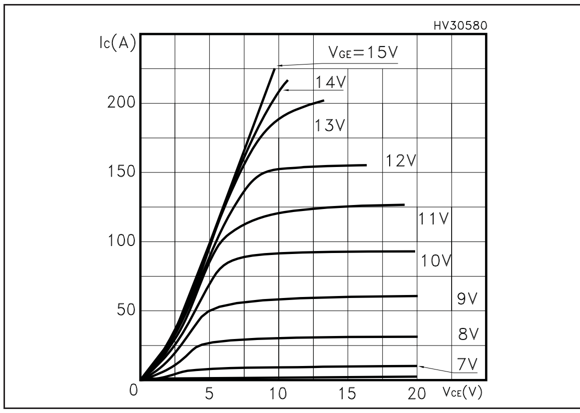


Figure 3. Transfer characteristics

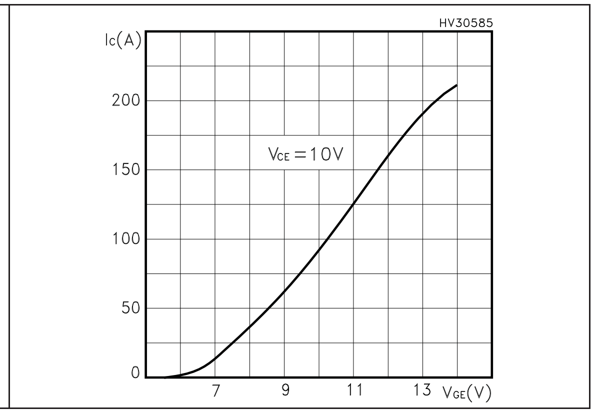


Figure 4. Transconductance

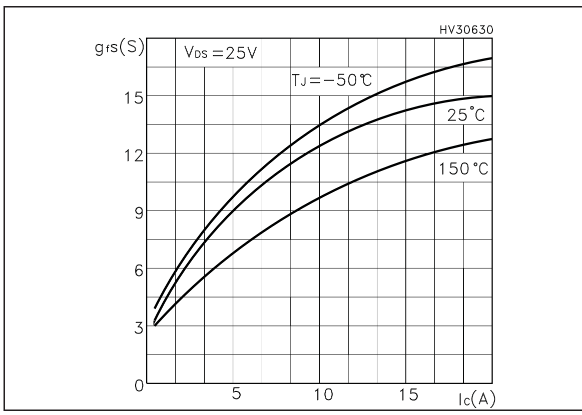


Figure 5. Collector-emitter on voltage vs. temperature

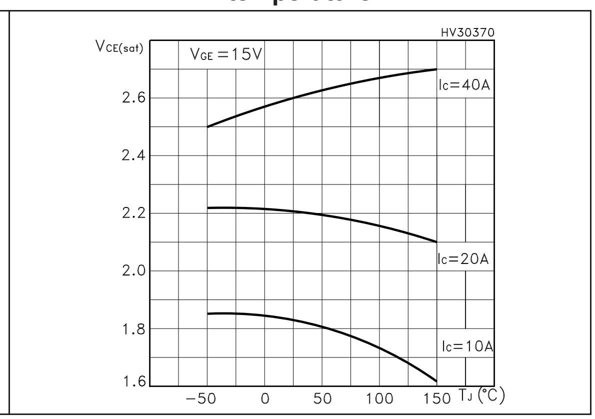


Figure 6. Gate charge vs. gate-source voltage

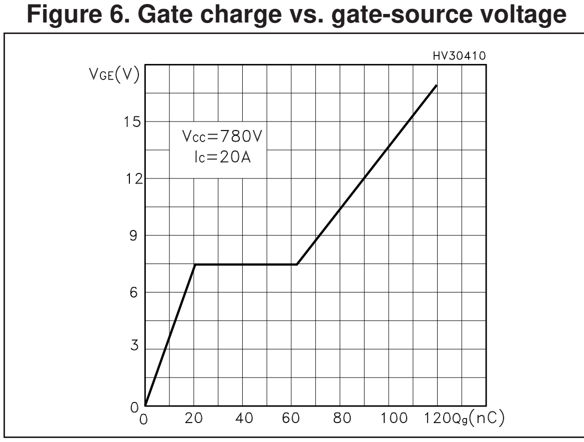


Figure 7. Capacitance variations

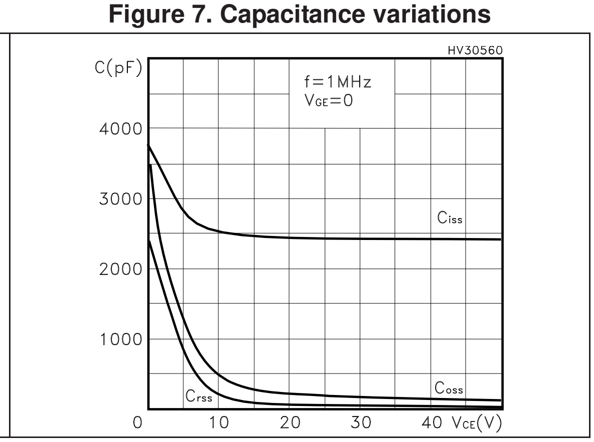


Figure 8. Normalized gate threshold voltage vs. temperature

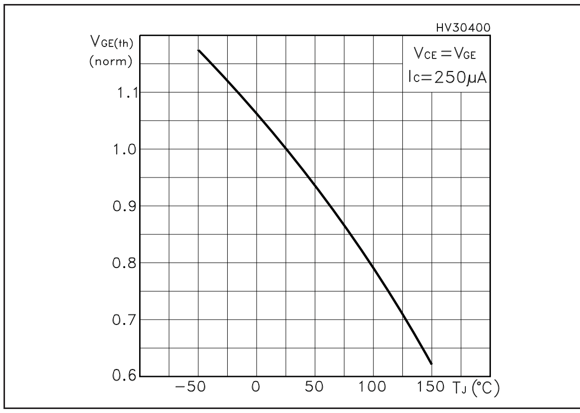


Figure 9. Collector-emitter on voltage vs. collector current

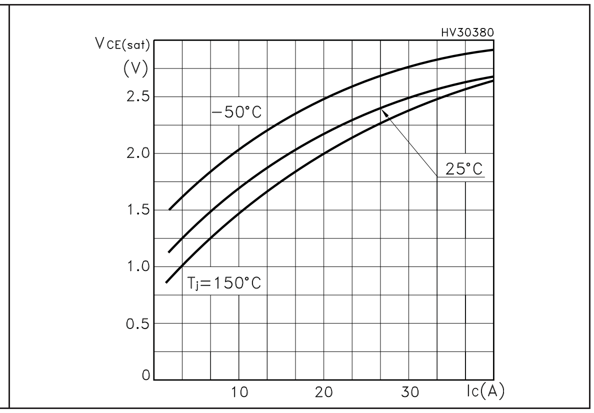


Figure 10. Normalized breakdown voltage vs. temperature

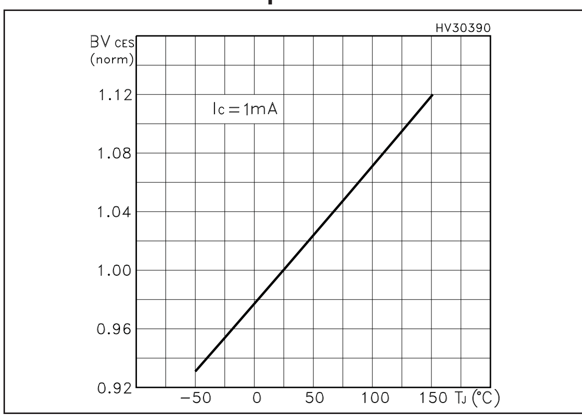


Figure 11. Switching losses vs. temperature

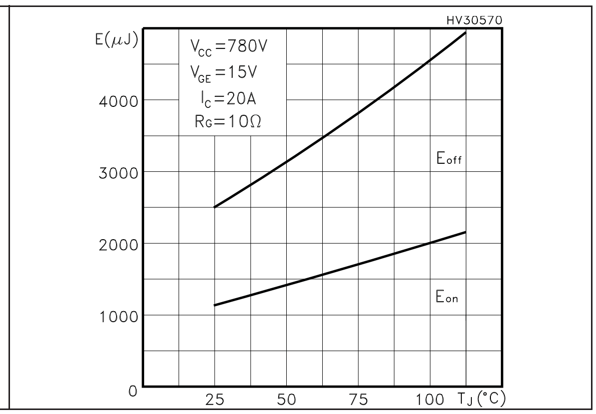


Figure 12. Switching losses vs. gate resistance

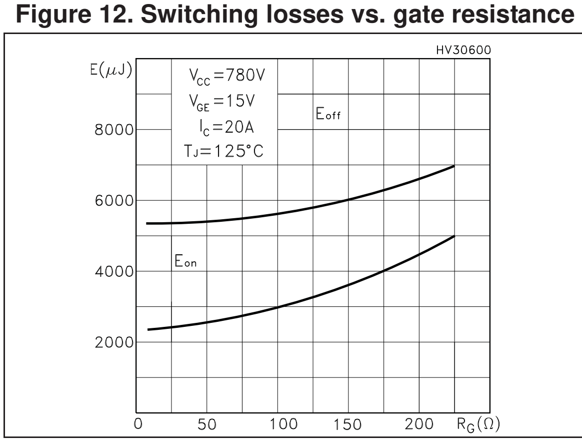


Figure 13. Switching losses vs. collector current

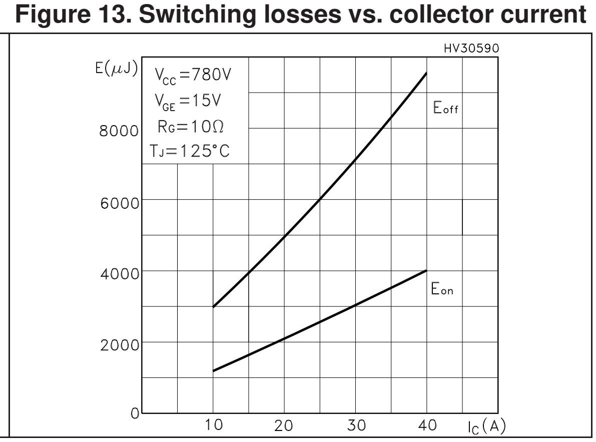


Figure 14. Thermal Impedance

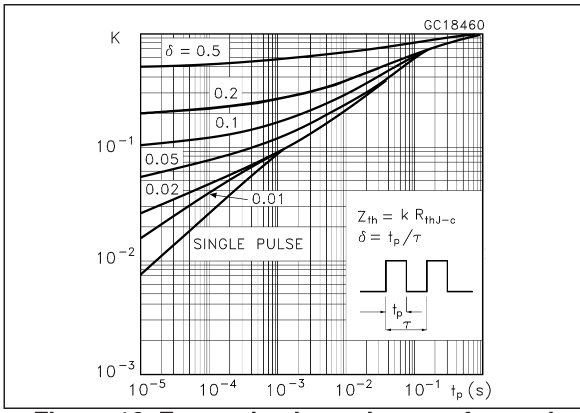


Figure 15. Reverse biased SOA

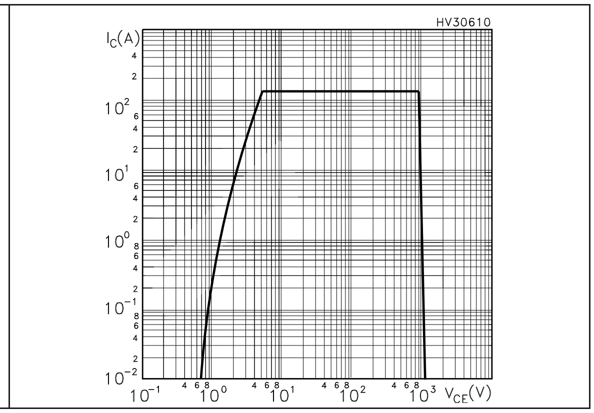
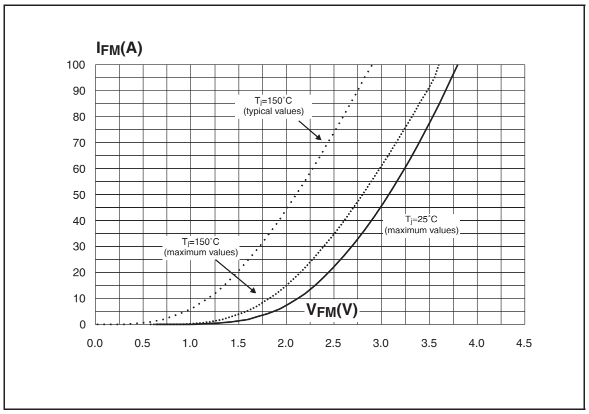


Figure 16. Forward voltage drop vs. forward current



3 Test circuits

Figure 17. Test circuit for inductive load switching

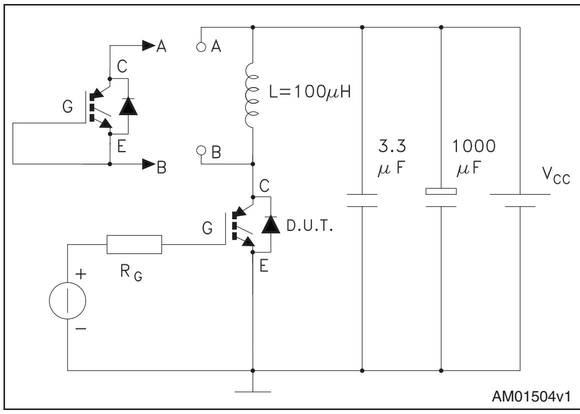


Figure 18. Gate charge test circuit

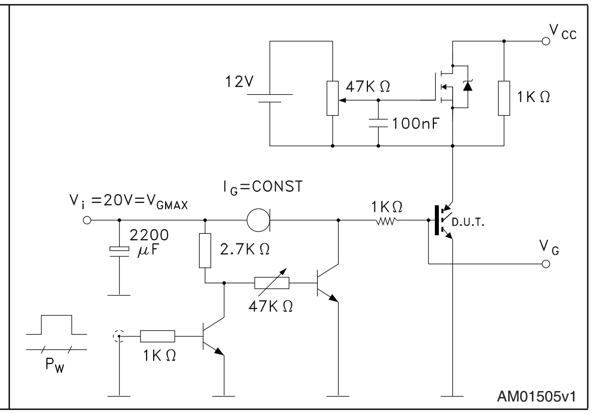


Figure 19. Switching waveform

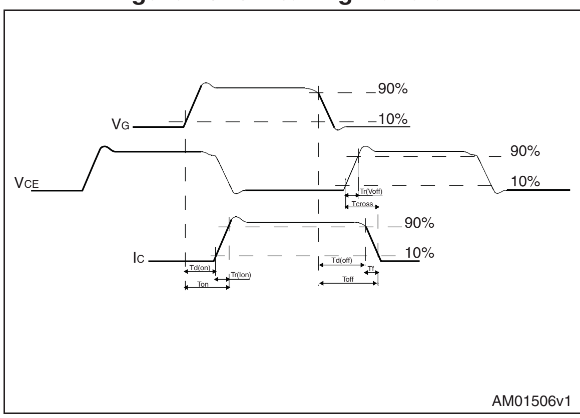
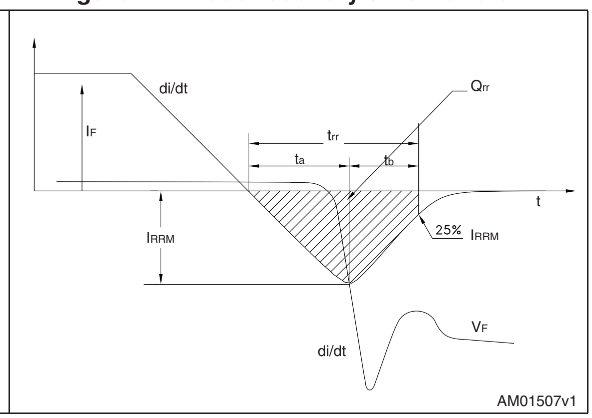


Figure 20. Diode recovery time waveform



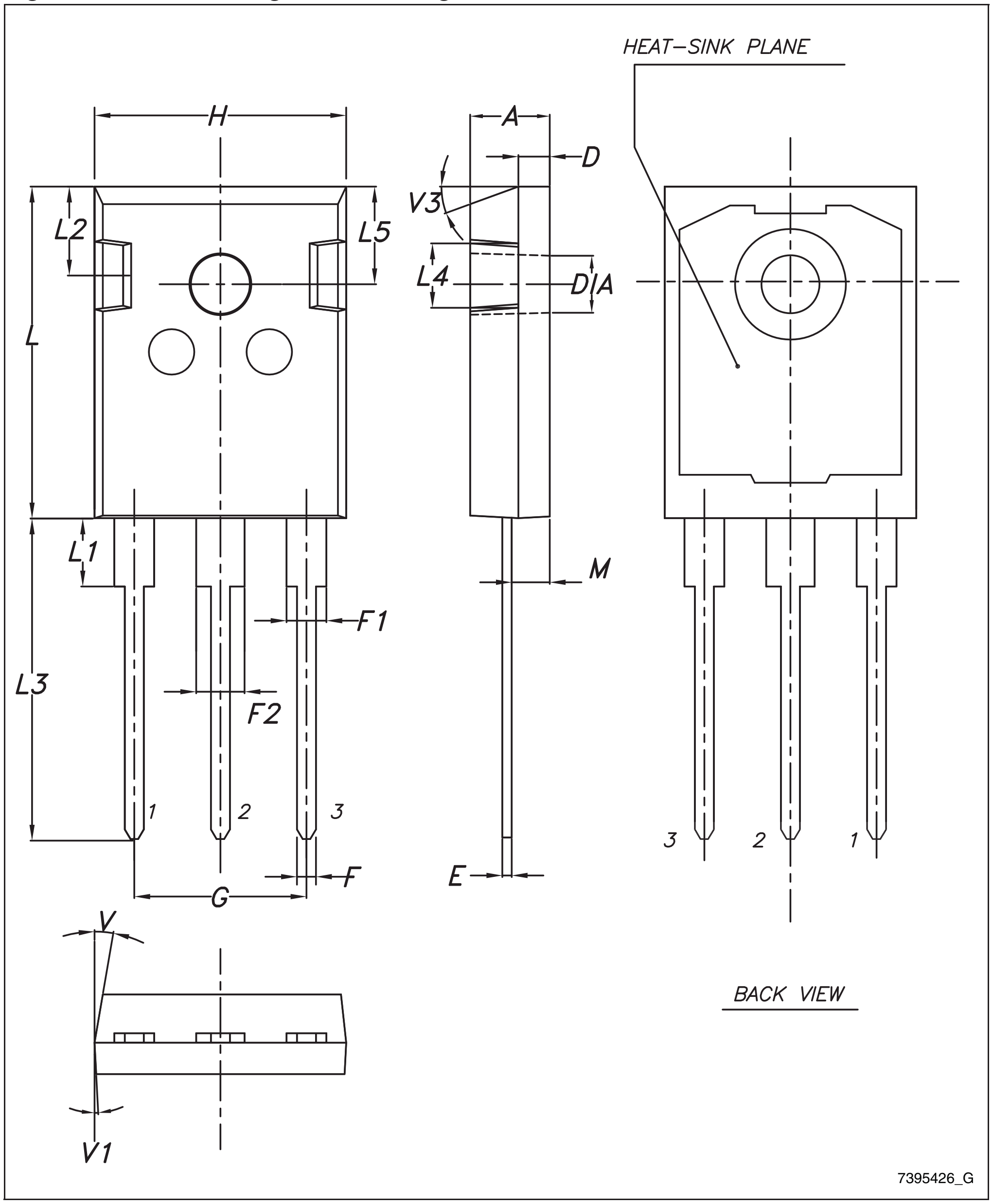
4 Package mechanical data

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 9. TO-247 long leads mechanical data

Dim.	mm		
	Min.	**Typ.**	**Max.**
A	4.90		5.15
D	1.85		2.10
E	0.55		0.67
F	1.07		1.32
F1	1.90		2.38
F2	2.87		3.38
G		10.90 BSC	
H	15.77		16.02
L	20.82		21.07
L1	4.16		4.47
L2	5.49		5.74
L3	20.05		20.30
L4	3.68		3.93
L5	6.04		6.29
M	2.25		2.55
V		10°	
V1		3°	
V3		20°	
Dia.	3.55		3.66

Figure 21. TO-247 long leads drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
25-Jan-2008	1	First issue.
07-May-2009	2	*Section 4: Package mechanical data* has been updated.
12-Dec-2013	3	Updated *Section 4: Package mechanical data*. Minor text changes.