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# 1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 30$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	45	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	28.4	A
$I_{DM}^{(1)}$	Drain current (pulsed)	180	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	390	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$T_{stg}$	Storage temperature range	-55 to 150	$^{\circ}\text{C}$
$T_j$	Operating junction temperature range		

**Notes:**

<sup>(1)</sup>Pulse width limited by safe operating area.

<sup>(2)</sup> $I_{SD} \leq 45\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS(\text{peak})} \leq V_{(BR)DSS}$ ,  $V_{DD} \leq 80\% V_{(BR)DSS}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-case}}$	Thermal resistance junction-case	0.32	$^{\circ}\text{C}/\text{W}$
$R_{thj\text{-amb}}$	Thermal resistance junction-ambient	30	$^{\circ}\text{C}/\text{W}$

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{j\text{ max}}$ )	15	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	700	mJ

## 2 Electrical characteristics

(T<sub>CASE</sub> = 25 °C unless otherwise specified)

**Table 5: On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0 V	500			V
I <sub>DSS</sub>	Zero gate voltage drain current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 500 V			10	μA
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 500 V, T <sub>C</sub> = 125 °C <sup>(1)</sup>			100	
I <sub>GSS</sub>	Gate-body leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±30 V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3	4	5	V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 22.5 A		0.08	0.1	Ω

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0 V	-	3290	-	pF
C <sub>oss</sub>	Output capacitance		-	865	-	pF
C <sub>rss</sub>	Reverse transfer capacitance		-	140	-	pF
C <sub>oss eq.</sub> <sup>(1)</sup>	Equivalent output capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 0 to 400 V	-	270	-	pF
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 45 A, V <sub>GS</sub> = 10 V (see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> )	-	113	-	nC
Q <sub>gs</sub>	Gate-source charge		-	17	-	nC
Q <sub>gd</sub>	Gate-drain charge		-	82	-	nC
R <sub>G</sub>	Gate input resistance	f = 1 MHz, I <sub>D</sub> = 0 A	-	1.7	-	Ω

**Notes:**

<sup>(1)</sup>C<sub>oss eq.</sub> is defined as a constant equivalent capacitance giving the same charging time as C<sub>oss</sub> when V<sub>DS</sub> increases from 0 to 80% V<sub>DS</sub>

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 250\text{ V}$ , $I_D = 22.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	29.1	-	ns
$t_r$	Rise time		-	73.6	-	ns
$t_{r(Voff)}$	Off-voltage rise time	$V_{DD} = 400\text{ V}$ , $I_D = 45\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	20.8	-	ns
$t_f$	Fall time		-	58.3	-	ns
$t_c$	Cross-over time		-	67.6	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		45	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		180	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 45\text{ A}$ , $V_{GS} = 0\text{ V}$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 45\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	454		ns
$Q_{rr}$	Reverse recovery charge		-	9380		nC
$I_{RRM}$	Reverse recovery current		-	41.3		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 45\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	567		ns
$Q_{rr}$	Reverse recovery charge		-	12700		nC
$I_{RRM}$	Reverse recovery current		-	44.8		A

**Notes:**

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

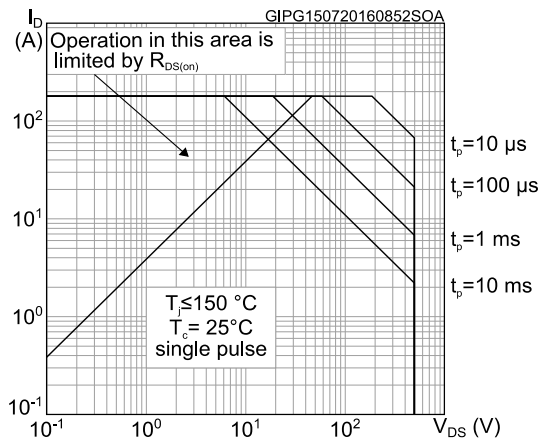


Figure 3: Thermal impedance

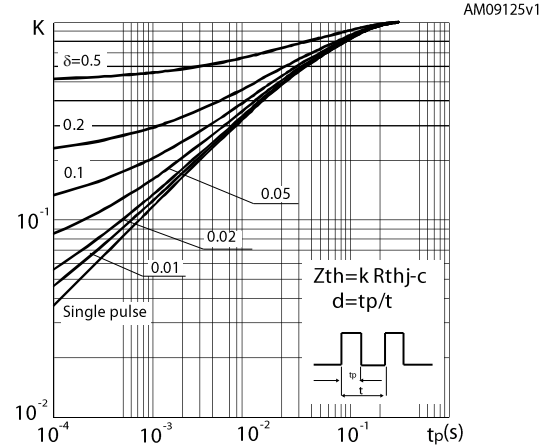


Figure 4: Output characteristics

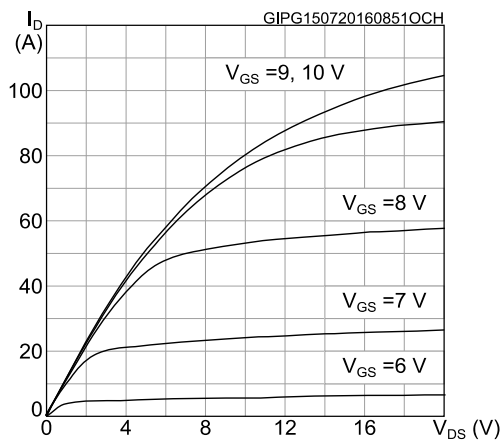


Figure 5: Transfer characteristics

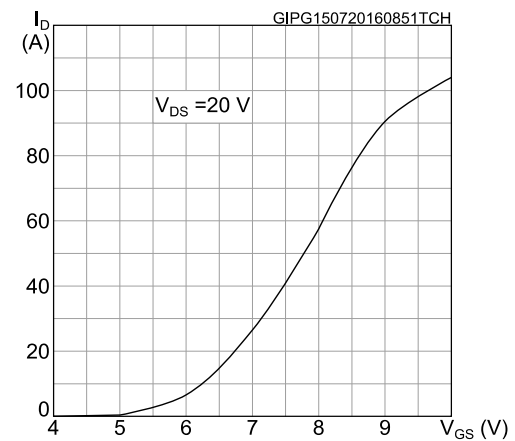


Figure 6: Gate charge vs gate-source voltage

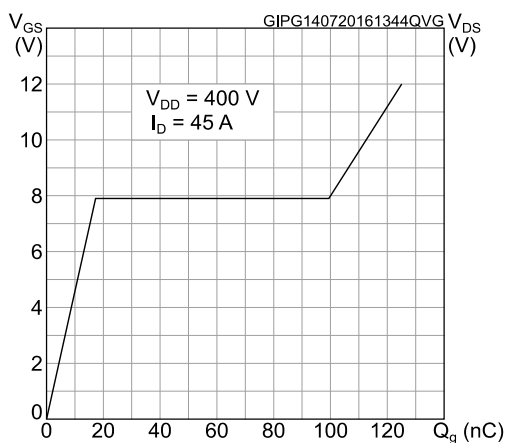


Figure 7: Static drain-source on resistance

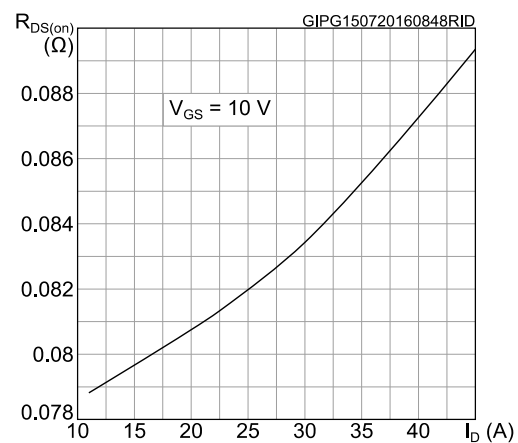


Figure 8: Capacitance variations

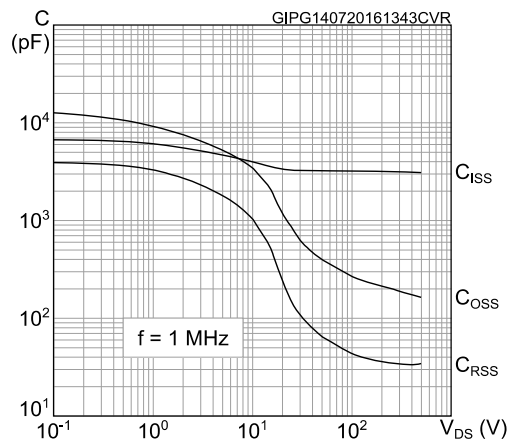


Figure 9: Normalized gate threshold voltage vs temperature

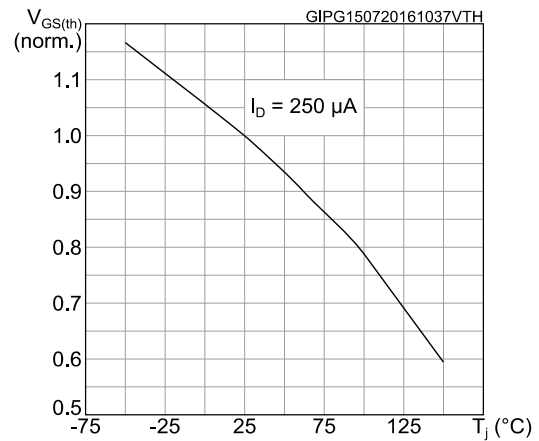


Figure 10: Normalized on-resistance vs temperature

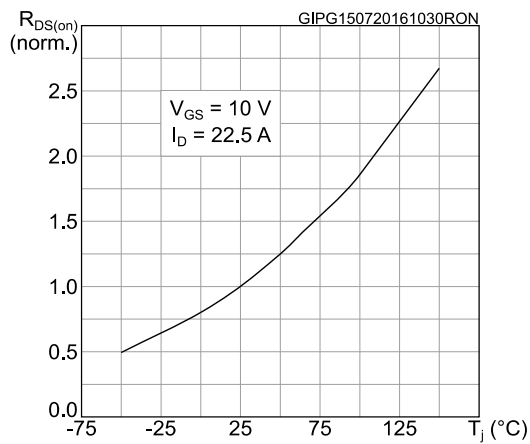


Figure 11: Normalized V(BR)DSS vs temperature

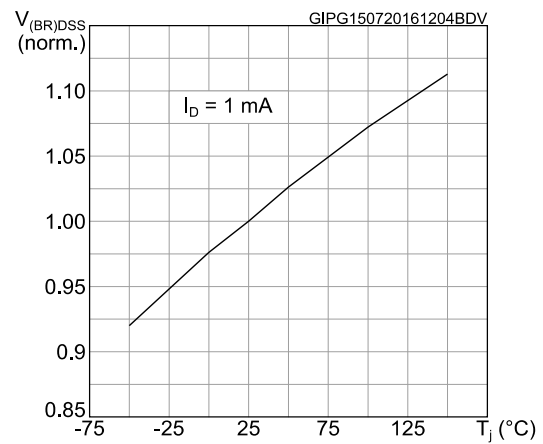
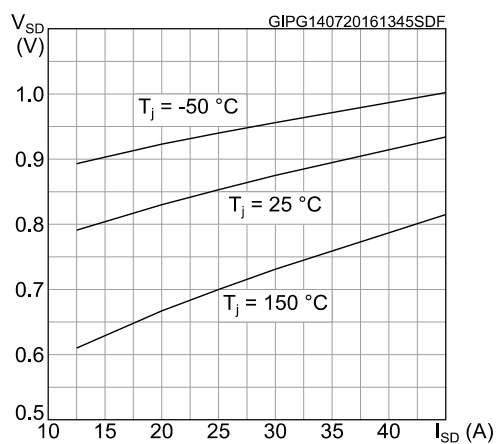
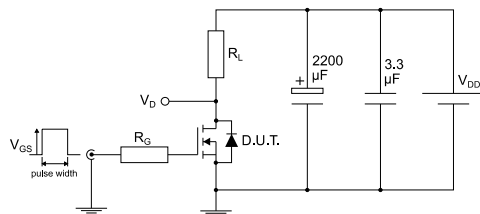


Figure 12: Source-drain diode forward characteristics



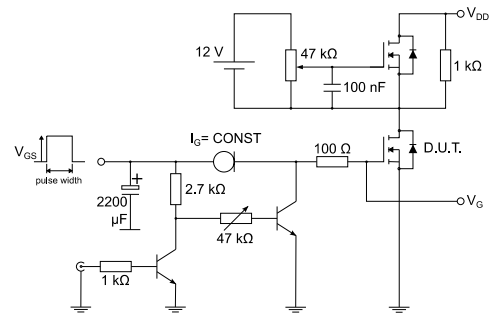
### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



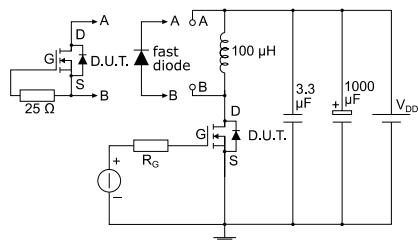
AM01468v1

**Figure 14: Test circuit for gate charge behavior**



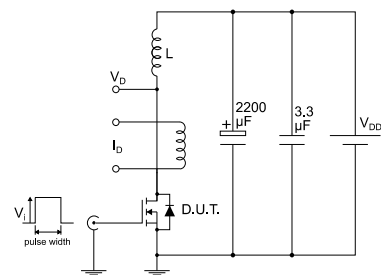
AM01469v1

**Figure 15: Test circuit for inductive load switching and diode recovery times**



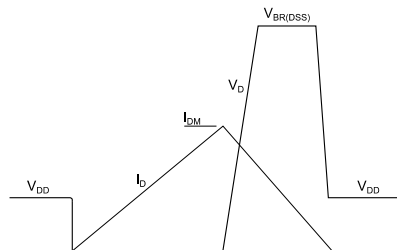
AM01470v1

**Figure 16: Unclamped inductive load test circuit**



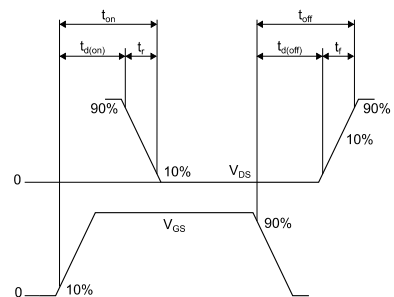
AM01471v1

**Figure 17: Unclamped inductive waveform**



AM01472v1

**Figure 18: Switching time waveform**



AM01473v1

## 4 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 TO-247 package information

Figure 19: TO-247 package outline

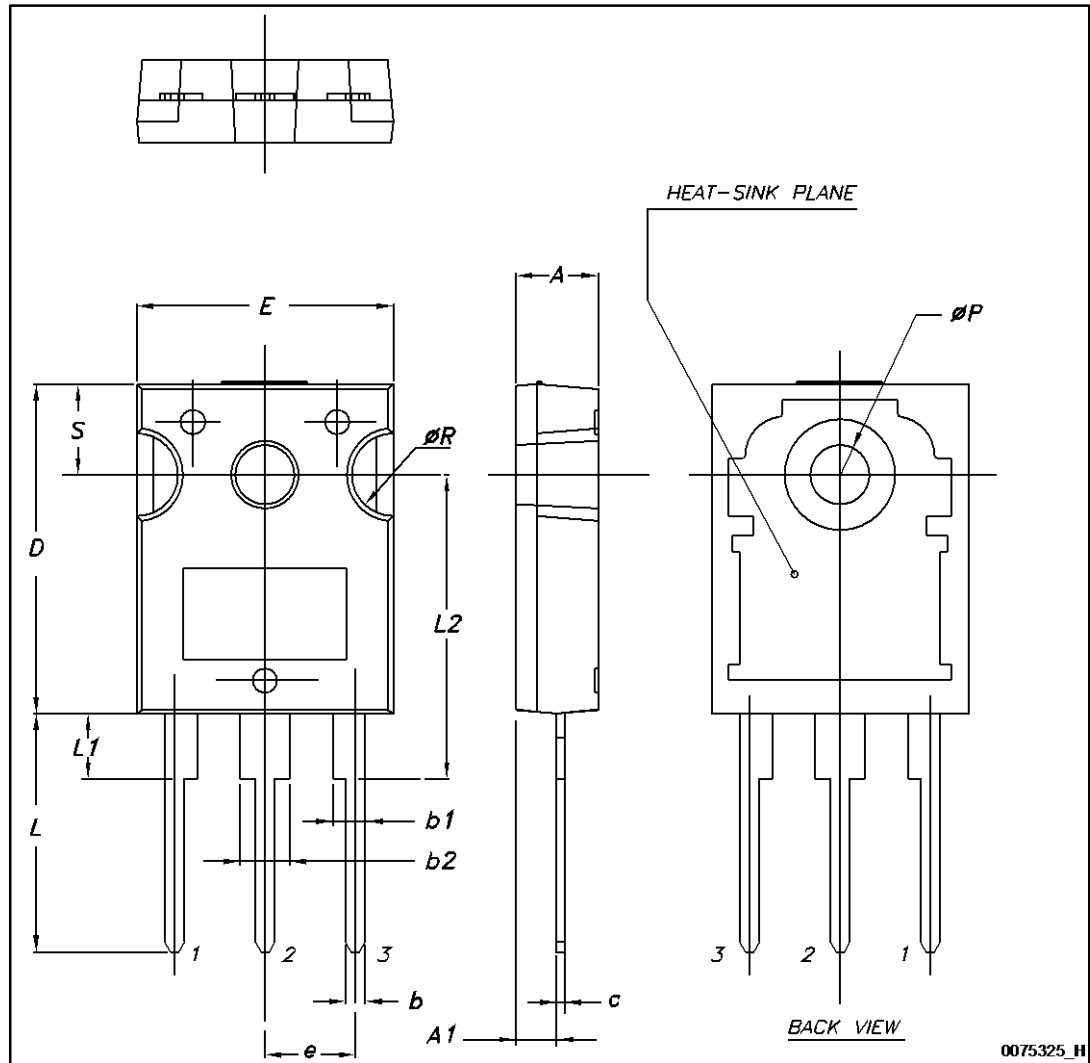




Table 9: TO-247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

## 5 Revision history

**Table 10: Document revision history**

Date	Revision	Changes
30-Mar-2005	4	Modified value on <i>Source drain diode</i>
23-Jul-2009	5	Modified values on <i>Switching times</i>
18-Jul-2016	6	Modified: <a href="#">Table 2: "Absolute maximum ratings"</a> , <a href="#">Table 3: "Thermal data"</a> , <a href="#">Table 4: "Avalanche characteristics"</a> , <a href="#">Table 5: "On/off states"</a> , <a href="#">Table 6: "Dynamic"</a> , <a href="#">Table 7: "Switching times"</a> and <a href="#">Table 8: "Source-drain diode"</a> Modified: <a href="#">Section 5.1: "Electrical characteristics (curves)"</a> Updated: <a href="#">Section 7.1: "TO-247 package information"</a>

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