

ACEPACK™ 1 - sixpack topology - 1200 V, 35 A trench gate field-stop IGBT M series, soft diode and NTC

Datasheet - production data

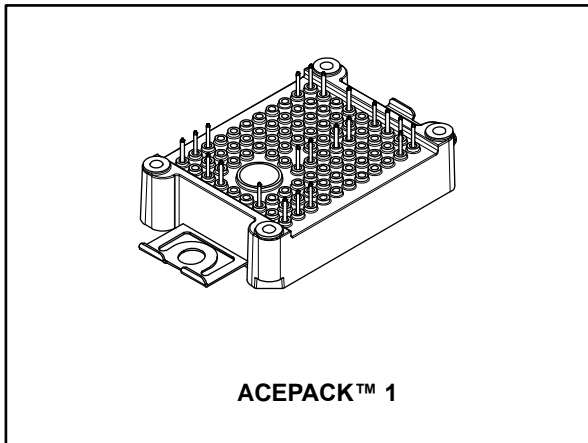
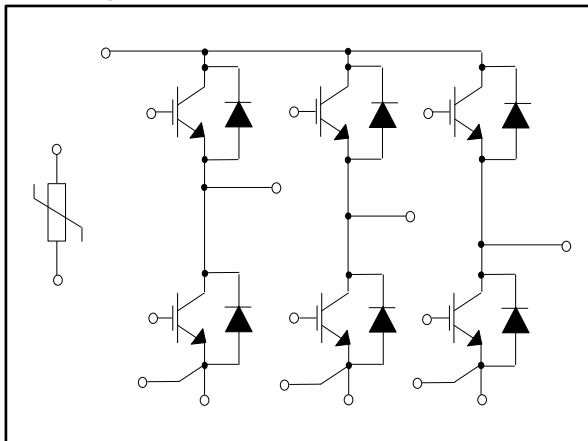


Figure 1: Internal electrical schematic



Features

- ACEPACK™ 1 power module
 - DBC Cu Al₂O₃ Cu
- Sixpack topology
 - 1200 V, 35 A IGBTs and diodes
 - $V_{CE(sat)}$: 1.95 V @ $I_C = 35$ A
 - Soft and fast recovery diode
- Integrated NTC

Applications

- Inverters
- Industrial
- Motor drives

Description

This power module is a sixpack topology in an ACEPACK™ 1 package with NTC, integrating the advanced trench gate field-stop technologies from STMicroelectronics. This new IGBT technology represents the best compromise between conduction and switching loss, to maximize the efficiency of any converter system up to 20 kHz.

Table 1: Device summary

Order code	Marking	Package	Leads type
A1P35S12M3	A1P35S12M3	ACEPACK™ 1	Solder contact pins

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1 Electrical ratings

1.1 IGBT

Limiting values at $T_j = 25\text{ °C}$, unless otherwise specified.

Table 2: Absolute maximum ratings of the IGBT

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$)	1200	V
I_C	Continuous collector current ($T_c = 100\text{ °C}$)	35	A
$I_{CP}^{(1)}$	Pulsed collector current	70	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total power dissipation	250	W
T_{JMAX}	Maximum junction temperature	175	$^{\circ}\text{C}$
T_{Jop}	Operative temperature range under switching conditions	-40 to 150	$^{\circ}\text{C}$

Notes:

⁽¹⁾Pulse width limited by maximum junction temperature.

Table 3: Electrical characteristics of the IGBT

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$I_C = 1\text{ mA}$, $V_{GE} = 0\text{ V}$	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 35\text{ A}$		1.95	2.45	V
		$V_{GE} = 15\text{ V}$, $I_C = 35\text{ A}$, $T_J = 150\text{ °C}$		2.3		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	5	6	7	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$			100	μA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 500	nA
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$		2154		pF
C_{oes}	Output capacitance			164		pF
C_{res}	Reverse transfer capacitance			86		pF
Q_g	Total gate charge	$V_{CC} = 960\text{ V}$, $I_C = 35\text{ A}$, $V_{GE} = \pm 15\text{ V}$		163		nC
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 600\text{ V}$, $I_C = 35\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $di/dt = 1900\text{ A}/\mu\text{s}$		122		ns
t_r	Current rise time			17		ns
$E_{on}^{(1)}$	Turn-on switching energy				1.21	
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 600\text{ V}$, $I_C = 35\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $dv/dt = 7800\text{ V}/\mu\text{s}$;		142		ns
t_f	Current fall time			150		ns
$E_{off}^{(2)}$	Turn-off switching energy				2.19	

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 600\text{ V}$, $I_C = 35\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $di/dt = 1533\text{ A}/\mu\text{s}$, $T_J = 150\text{ }^\circ\text{C}$		124		ns
t_r	Current rise time			18		ns
E_{on}	Turn-on switching energy			1.8		mJ
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 600\text{ V}$, $I_C = 35\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $dv/dt = 6700\text{ V}/\mu\text{s}$, $T_J = 150\text{ }^\circ\text{C}$		142		ns
t_f	Current fall time			256		ns
E_{off}	Turn-off switching energy			3.1		mJ
t_{SC}	Short-circuit withstand time	$V_{CC} \leq 600\text{ V}$, $V_{GE} \leq 15\text{ V}$, $T_{Jstart} \leq 150\text{ }^\circ\text{C}$	10			μs
R_{THj-c}	Thermal resistance junction to case	Each IGBT		0.55	0.60	$^\circ\text{C}/\text{W}$
R_{THc-h}	Thermal resistance case to heatsink	Each IGBT, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot^\circ\text{C})$		0.70		$^\circ\text{C}/\text{W}$

Notes:

(1)Including the reverse recovery of the diode.

(2)Including the tail of the collector current.

1.2 Diode

Table 4: Absolute maximum ratings of the diode

Symbol	Parameter	Value	Unit
V_{RRM}	Repetitive peak reverse voltage	1200	V
I_F	Continuous forward current at ($T_C = 100\text{ }^\circ\text{C}$)	35	A
$I_{FP}^{(1)}$	Pulsed forward current	70	A
T_{JMAX}	Maximum junction temperature	175	$^\circ\text{C}$
T_{Jop}	Operative temperature range under switching conditions	-40 to 150	$^\circ\text{C}$

Notes:

(1)Pulse width limited by maximum junction temperature.

Table 5: Electrical characteristics of the diode

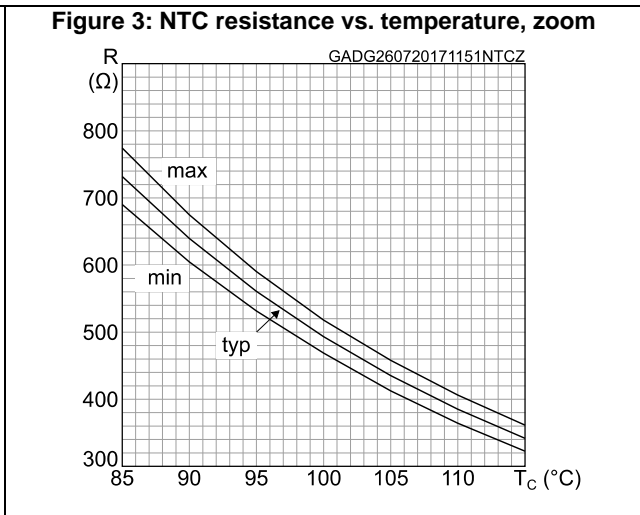
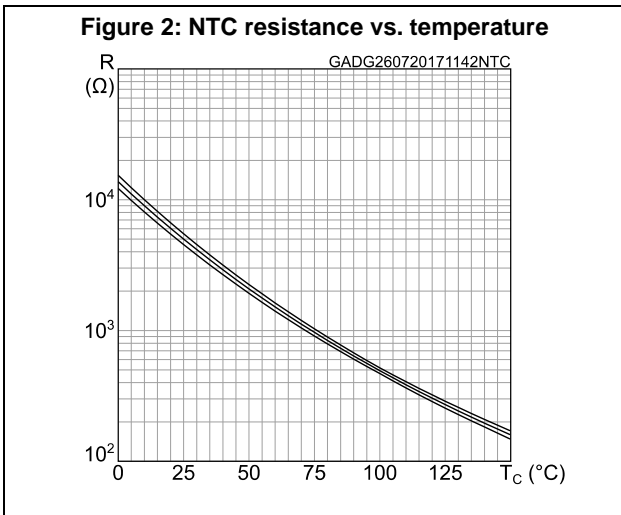
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward voltage	$I_F = 35\text{ A}$	-	2.95	4.1	V
		$I_F = 35\text{ A}$, $T_J = 150\text{ }^\circ\text{C}$	-	2.3		
t_{rr}	Reverse recovery time	$I_F = 35\text{ A}$, $V_R = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $di/dt = 1900\text{ A}/\mu\text{s}$	-	140		ns
Q_{rr}	Reverse recovery charge		-	2.62		μC
I_{rrm}	Reverse recovery current		-	54		A
E_{rec}	Reverse recovery energy		-	1.2		mJ

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	$I_F = 35\text{ A}$, $V_R = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $di/dt = 1533\text{ A}/\mu\text{s}$, $T_J = 150\text{ }^\circ\text{C}$	-	350		ns
Q_{rr}	Reverse recovery charge		-	6.6		μC
I_{rrm}	Reverse recovery current		-	63		A
E_{rec}	Reverse recovery energy		-	3.2		mJ
R_{THj-c}	Thermal resistance junction to case	Each diode	-	0.8	0.9	$^\circ\text{C}/\text{W}$
R_{THc-h}	Thermal resistance case to heatsink	Each diode, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot^\circ\text{C})$	-	0.75		$^\circ\text{C}/\text{W}$

1.3 NTC

Table 6: NTC temperature sensor, considered as stand-alone

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
R_{25}	Resistance	$T = 25^\circ\text{C}$		5		$\text{k}\Omega$
R_{100}	Resistance	$T = 100^\circ\text{C}$		493		Ω
$\Delta R/R$	Deviation of R_{100}		-5		+5	%
$B_{25/50}$	B-constant			3375		K
$B_{25/80}$	B-constant			3411		K
T	Operating temperature range		-40		150	$^\circ\text{C}$

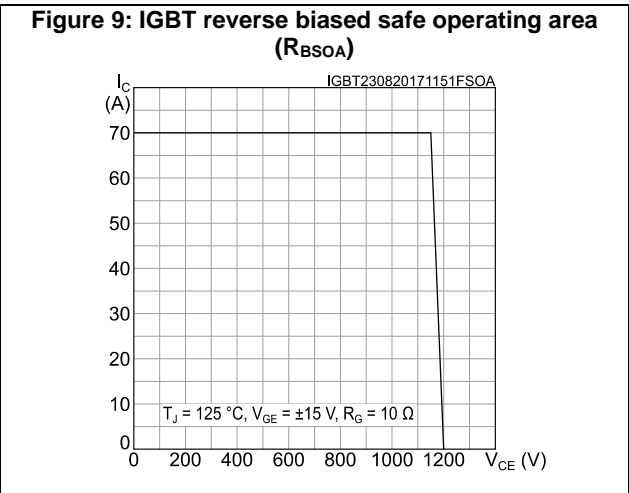
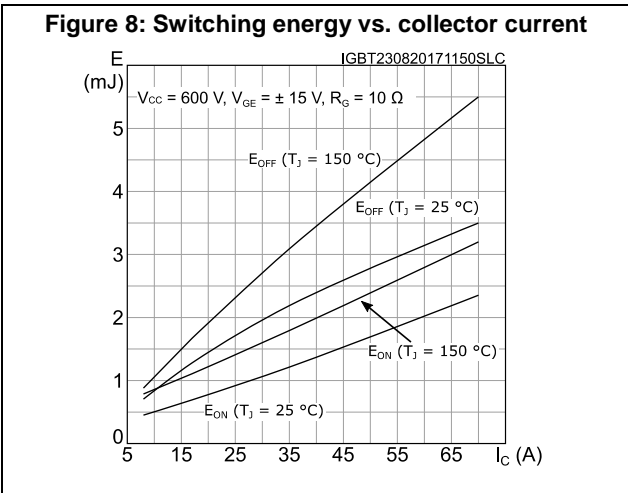
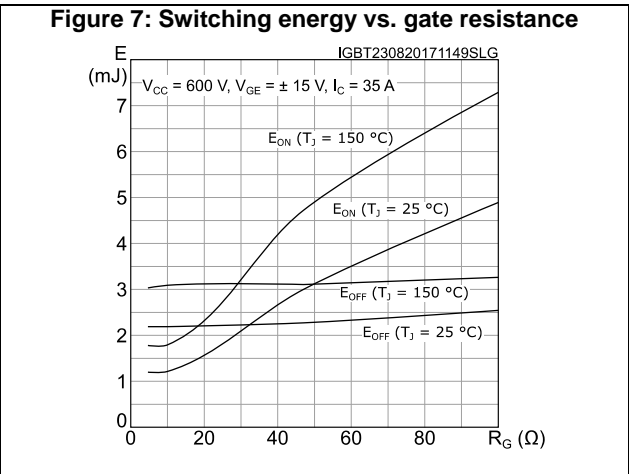
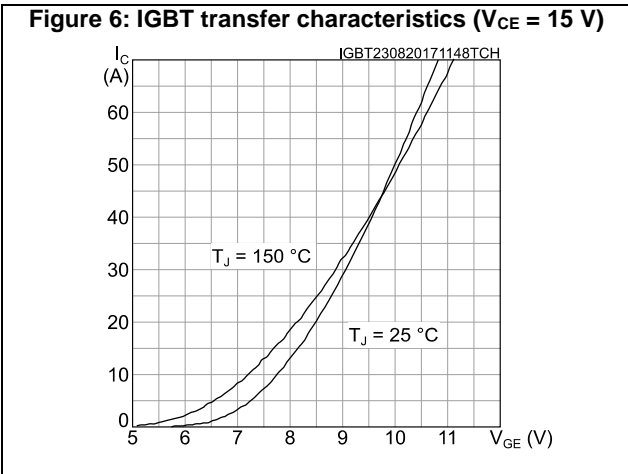
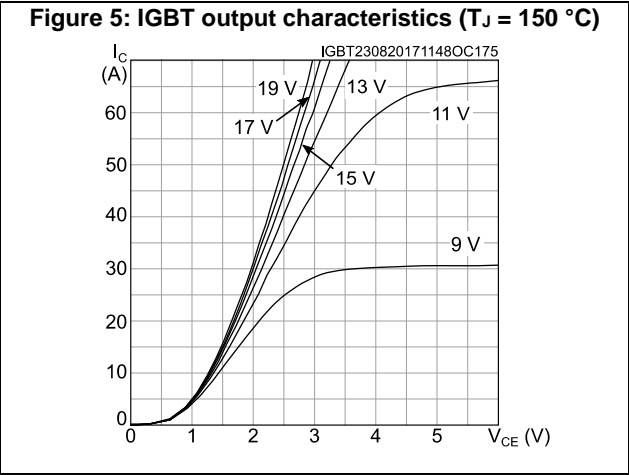
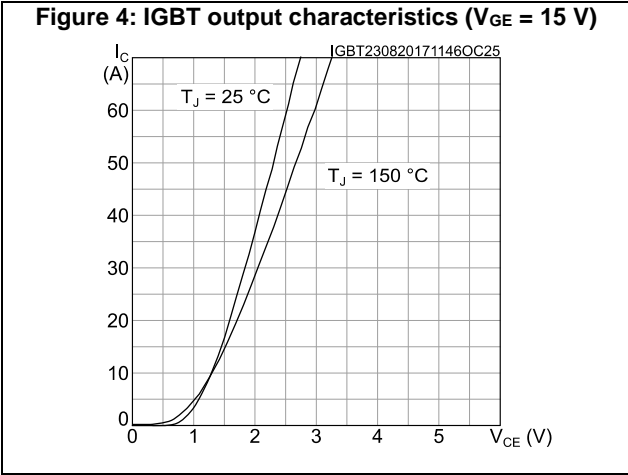


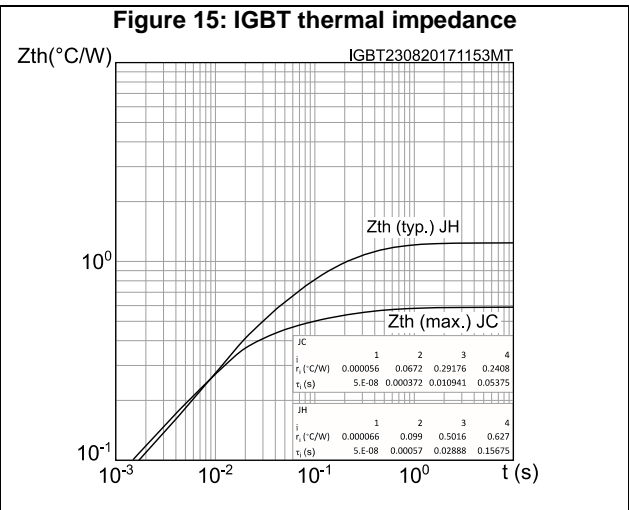
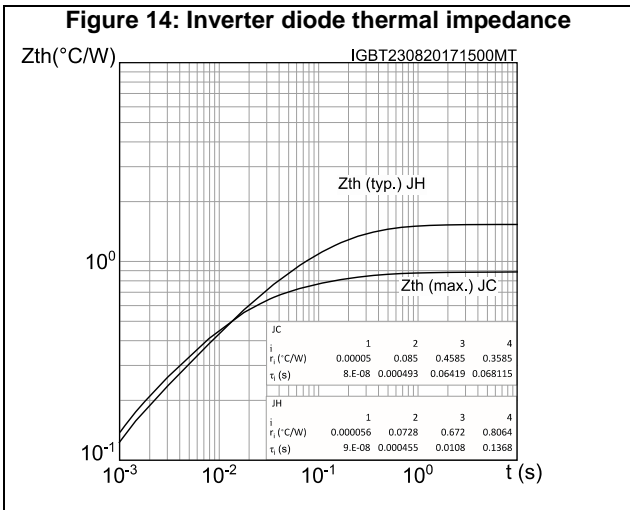
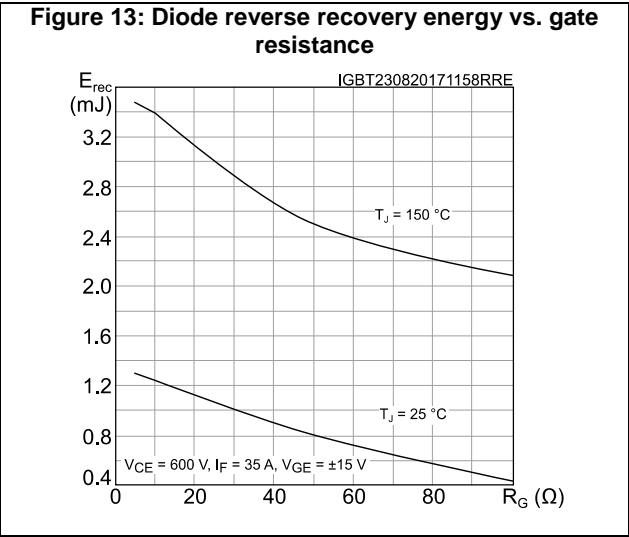
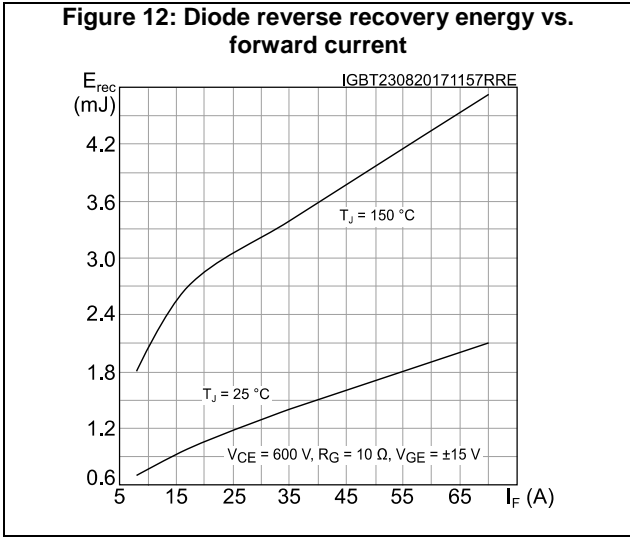
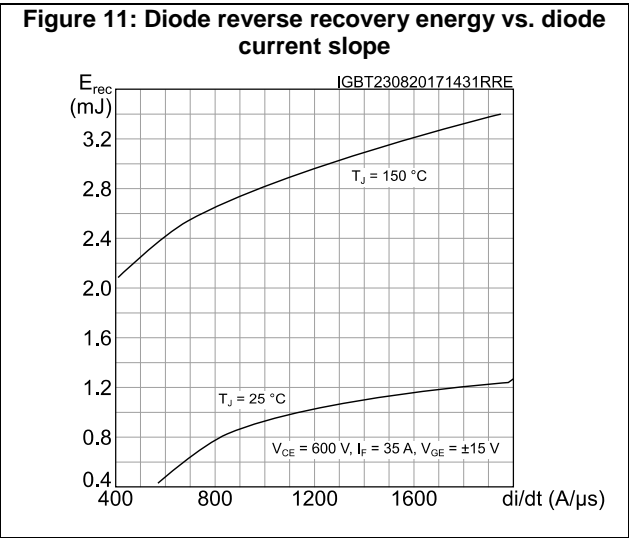
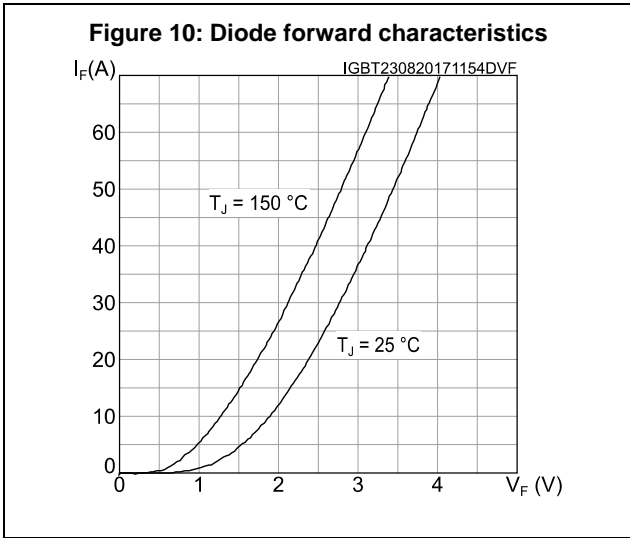
1.4 Package

Table 7: ACEPACK™ 1 package

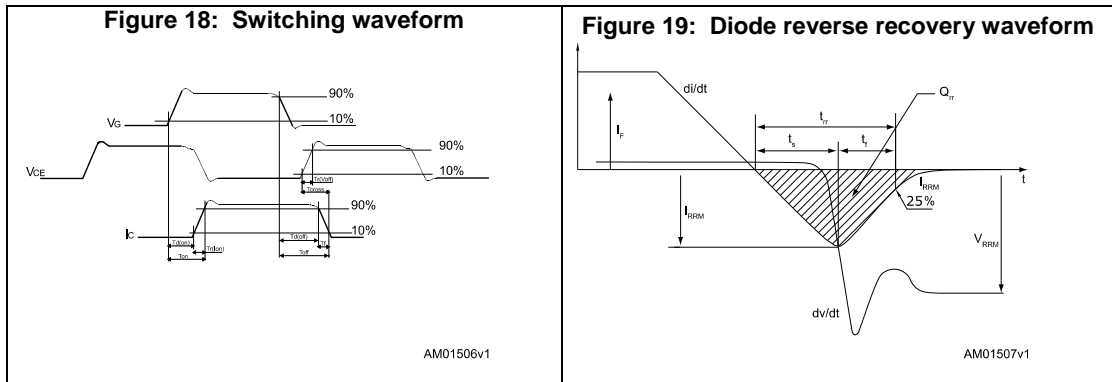
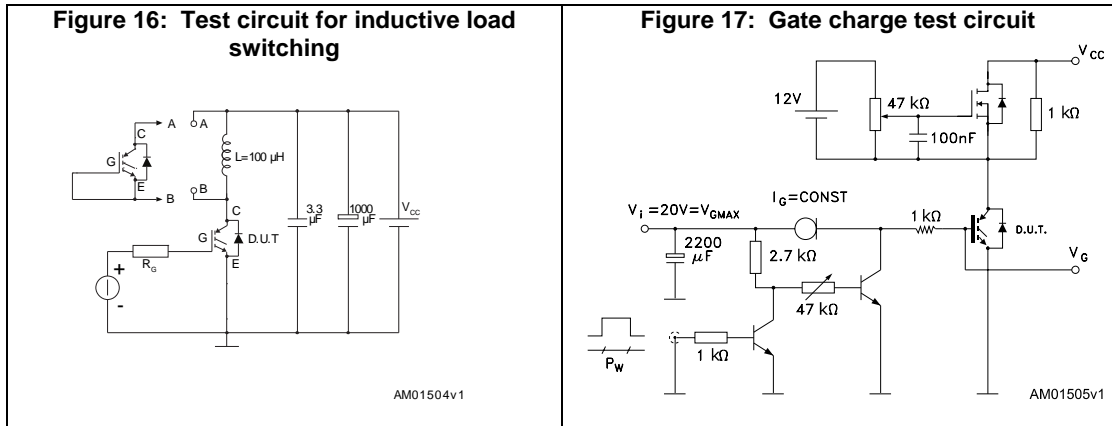
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{isol}	Isolation voltage (AC voltage, $t = 60$ s)			2500	V
M_d	Screw mounting torque	40		80	Nm
T_{stg}	Storage temperature	-40		125	°C
CTI	Comparative tracking index	200			
L_s	Stray inductance module P1 - EW loop		28.7		nH
R_s	Module lead resistance, terminal to chip		3.9		mΩ

2 Electrical characteristics curves





3 Test circuits



4 Topology and pin description

Figure 20: Electrical topology and pin description

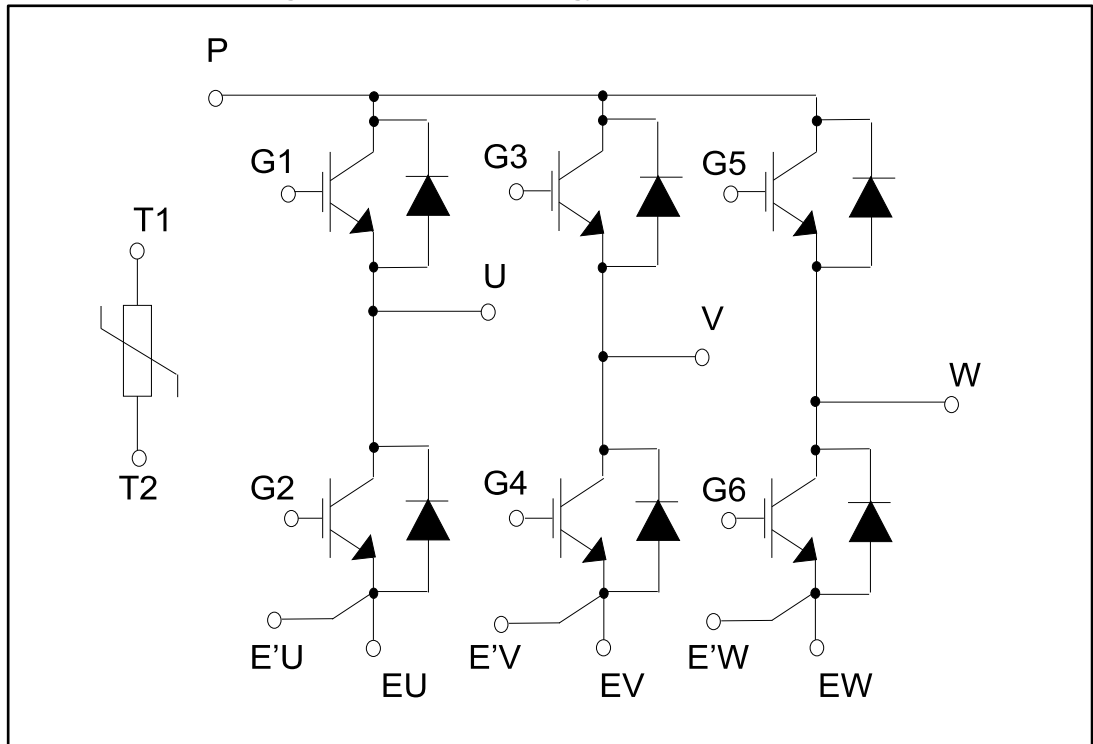
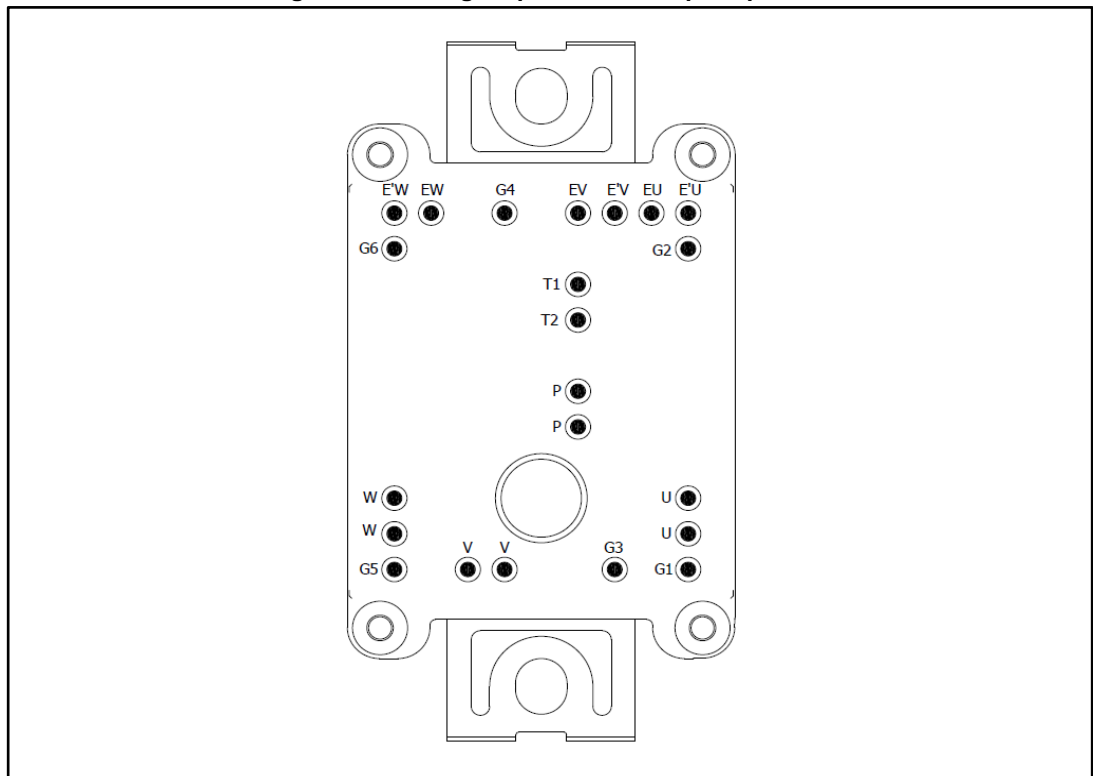


Figure 21: Package top view with sixpack pinout



6 Revision history

Table 8: Document revision history

Date	Revision	Changes
02-May-2016	1	Initial release.
24-Aug-2017	2	Updated title, features, description and <i>Table 1: "Device summary"</i> in cover page. Updated <i>Section 1: "Electrical ratings"</i> . Added <i>Section 2: "Electrical characteristics curves"</i> , <i>Section 3: "Test circuits"</i> , <i>Section 4: "Topology and pin description"</i> and <i>Section 5: "Package information"</i> . Minor text changes.
02-Oct-2017	3	Document status promoted from preliminary data to production data. Updated <i>Table 7: "ACEPACK™ 1 package"</i> and <i>Section 2: "Electrical characteristics curves"</i> . Minor text changes.

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