

ACEPACK™ 2 - sixpack topology - 1200 V, 75 A trench gate field-stop IGBT M series, soft diode and NTC

Datasheet - preliminary data

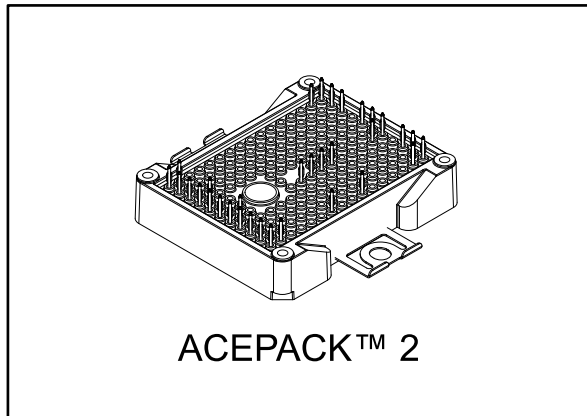
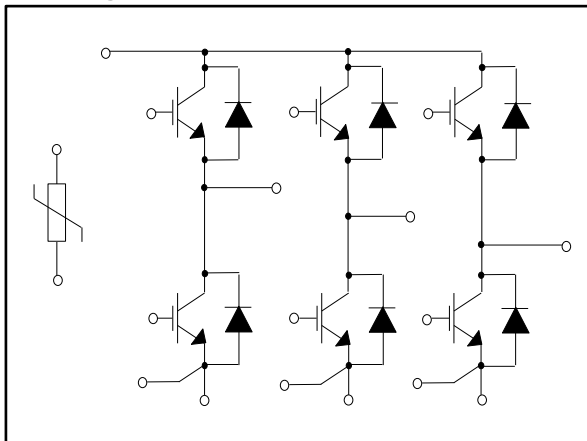


Figure 1: Internal electrical schematic



Features

- ACEPACK™ 2 power module
 - DBC Cu Al₂O₃ Cu
- Sixpack topology
 - 1200 V, 75 A IGBTs and diodes
 - V_{CE(sat)}: 1.95 V @ I_C = 75 A
 - Soft and fast recovery diode
- Integrated NTC

Applications

- Inverters
- Industrial
- Motor drives

Description

This power module is a sixpack topology in an ACEPACK™ 2 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
A2P75S12M3-F	A2P75S12M3-F	ACEPACK™ 2	Press fit 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 ($T_c = 100\text{ °C}$)	75	A
$I_{CP}^{(1)}$	Pulsed collector current	150	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total power dissipation	454.5	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	$V_{GE} = 15\text{ V}$, $I_C = 75\text{ A}$		1.95	2.3	V
		$V_{GE} = 15\text{ V}$, $I_C = 75\text{ A}$, $T_J = 150\text{ °C}$		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	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$		4700		pF
C_{oes}	Output capacitance			350		pF
C_{res}	Reverse transfer capacitance			190		pF
Q_g	Total gate charge	$V_{CC} = 960\text{ V}$, $I_C = 75\text{ A}$, $V_{GE} = \pm 15\text{ V}$		350		nC
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 600\text{ V}$, $I_C = 75\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $di/dt = 1900\text{ A}/\mu\text{s}$		198		ns
t_r	Current rise time			32		ns
$E_{on}^{(1)}$	Turn-on switching energy				3.59	

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 600\text{ V}$, $I_C = 75\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $dv/dt = 6000\text{ V}/\mu\text{s}$;		250		ns
t_f	Current fall time			159		ns
$E_{off}^{(2)}$	Turn-off switching energy				5.13	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 600\text{ V}$, $I_C = 75\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $di/dt = 1718\text{ A}/\mu\text{s}$, $T_J = 150\text{ }^\circ\text{C}$		200		ns
t_r	Current rise time			35		ns
E_{on}	Turn-on switching energy				6.28	
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 600\text{ V}$, $I_C = 75\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $dv/dt = 4900\text{ V}/\mu\text{s}$, $T_J = 150\text{ }^\circ\text{C}$		266		ns
t_f	Current fall time			251		ns
E_{off}	Turn-off switching energy				7.7	
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		0.30	0.33	$^\circ\text{C}/\text{W}$
R_{THc-h}	Thermal resistance case to heatsink	Each IGBT, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot^\circ\text{C})$		0.60		$^\circ\text{C}/\text{W}$

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 ($T_C = 100\text{ }^\circ\text{C}$)	75	A
$I_{FP}^{(1)}$	Pulsed forward current	150	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.

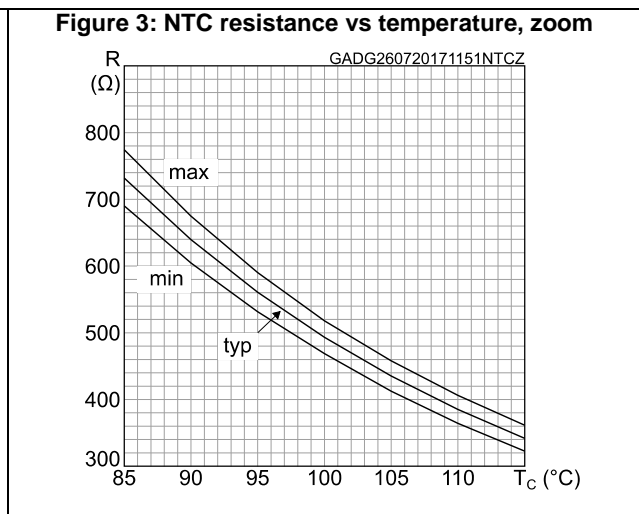
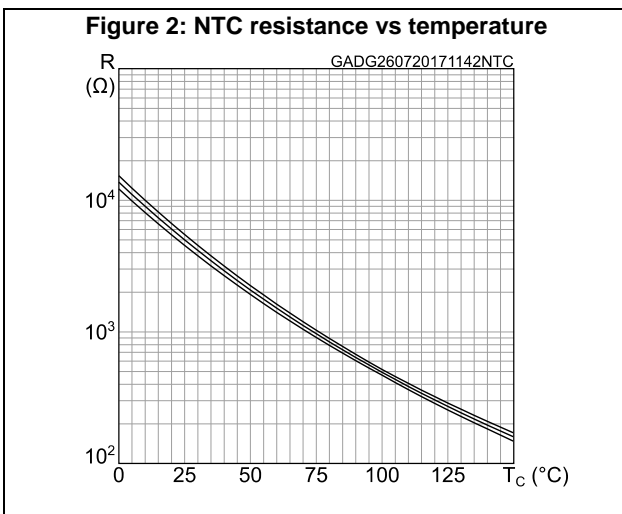
Table 5: Electrical characteristics of the diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _F	Forward voltage	I _F = 75 A	-	2.95	4.1	V
		I _F = 75 A, T _J = 150 °C	-	2.3		
t _{rr}	Reverse recovery time	I _F = 75 A, V _R = 600 V, V _{GE} = ±15 V, di/dt = 1900 A/μs	-	200		ns
Q _{rr}	Reverse recovery charge		-	6.0		μC
I _{rrm}	Reverse recovery current		-	78		A
E _{rec}	Reverse recovery energy		-	2.2		mJ
t _{rr}	Reverse recovery time	I _F = 75 A, V _R = 600 V, V _{GE} = ±15 V, di/dt = 1718 A/μs, T _J = 150 °C	-	500		ns
Q _{rr}	Reverse recovery charge		-	12.5		μC
I _{rrm}	Reverse recovery current		-	90		A
E _{rec}	Reverse recovery energy		-	5.2		mJ
R _{THj-c}	Thermal resistance junction to case	Each diode	-	0.55	0.60	°C/W
R _{THc-h}	Thermal resistance case to heatsink	Each diode, λ _{grease} = 1 W/(m·°C)	-	0.75		°C/W

1.3 NTC

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
R ₂₅	Resistance	T = 25°C		5		kΩ
R ₁₀₀	Resistance	T = 100°C		493		Ω
ΔR/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	°C

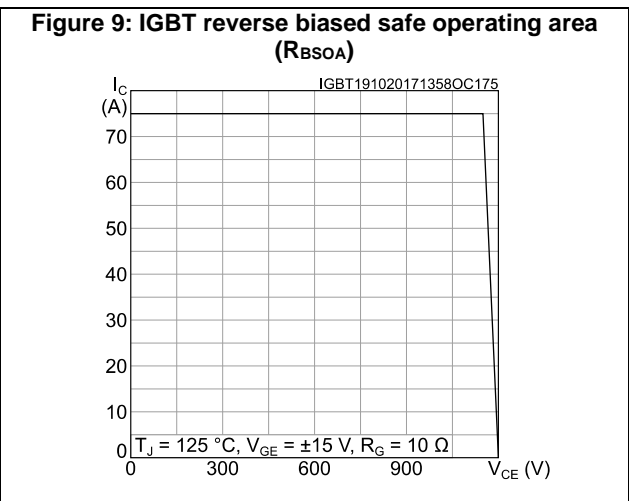
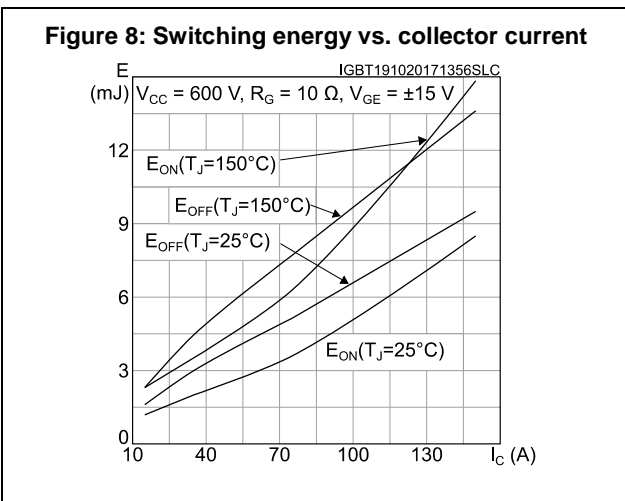
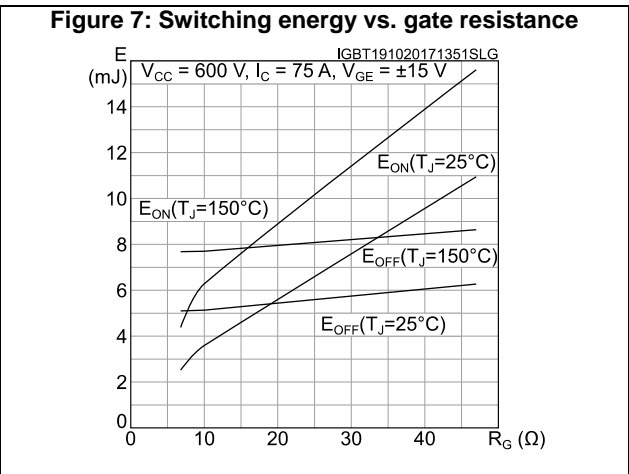
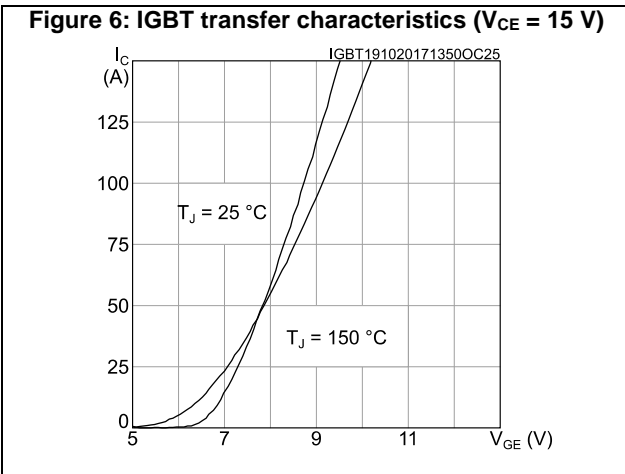
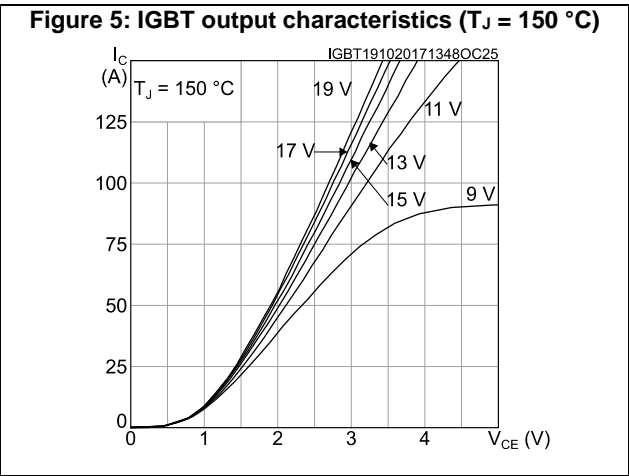
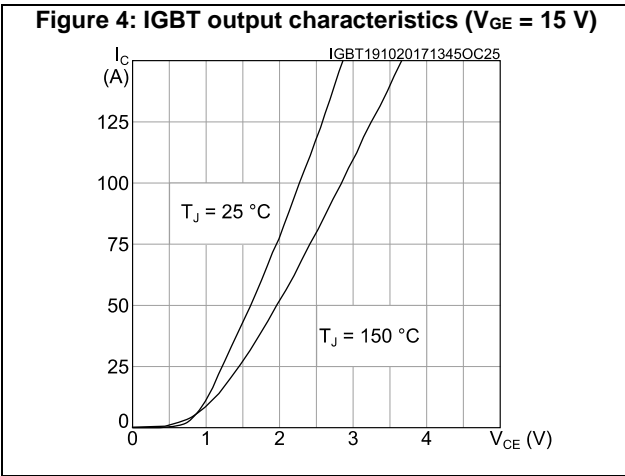


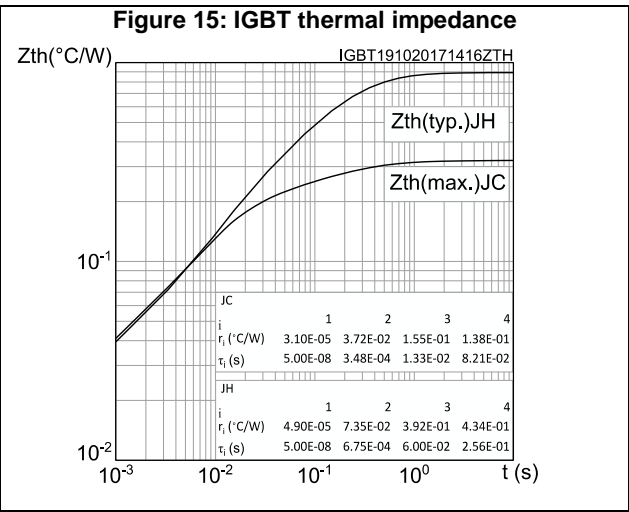
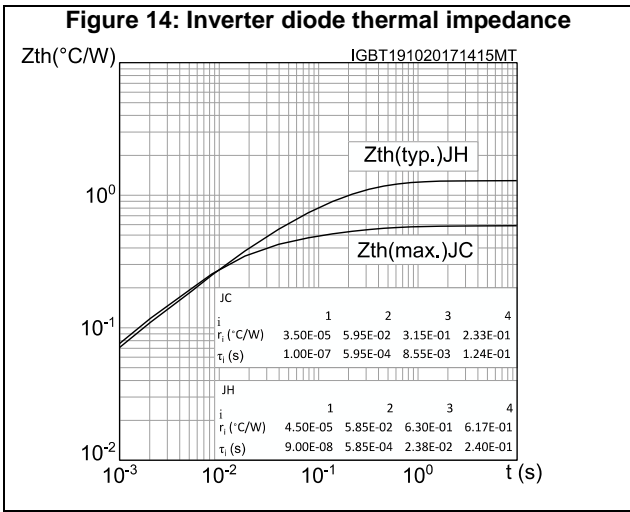
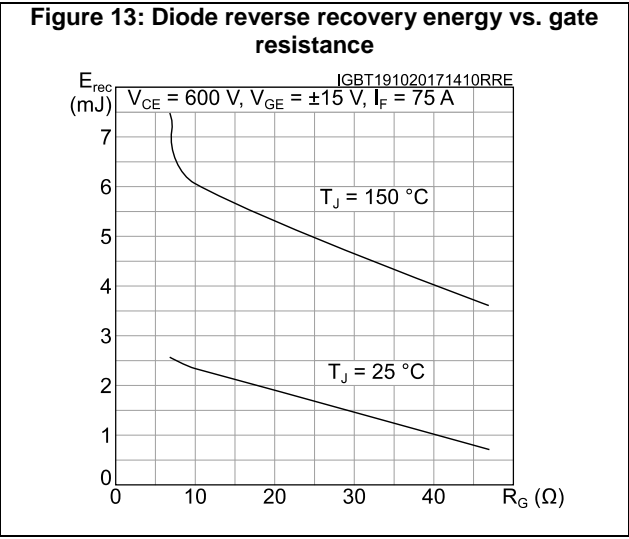
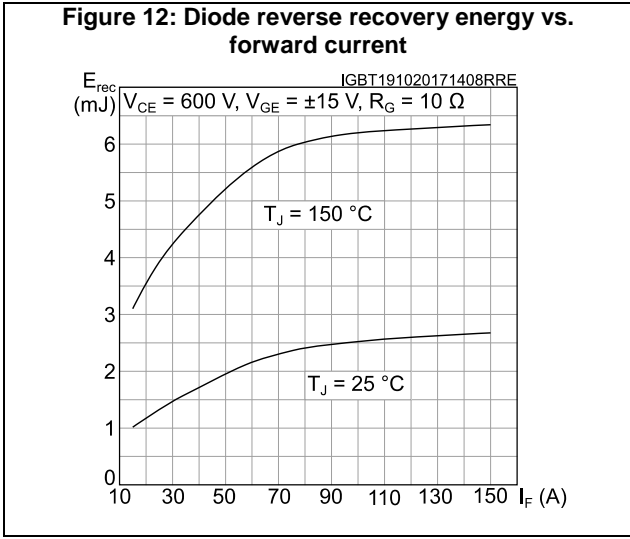
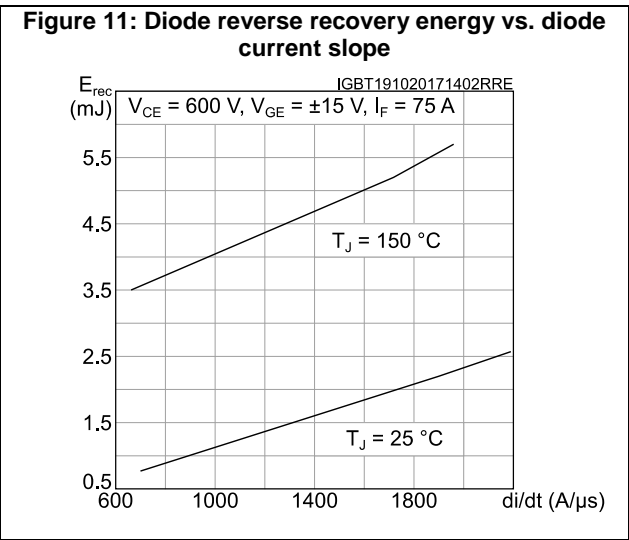
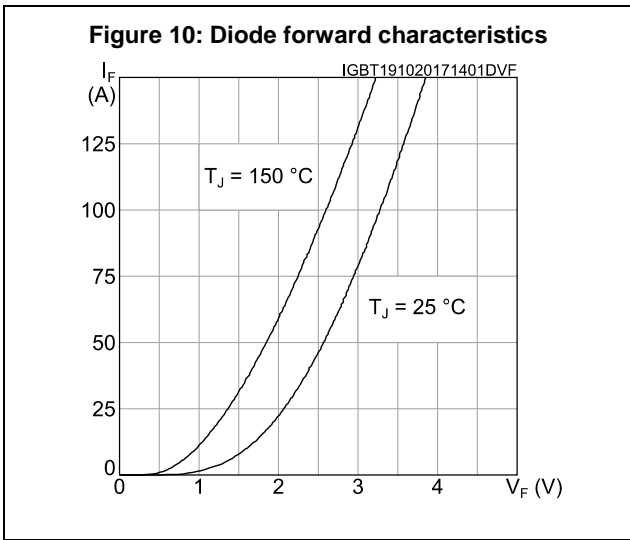
1.4 Package

Table 7: ACEPACK™ 2 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		33.5		nH
R_s	Module lead resistance, terminal to chip		3.6		mΩ

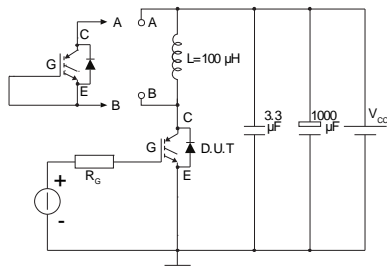
2 Electrical characteristics curves





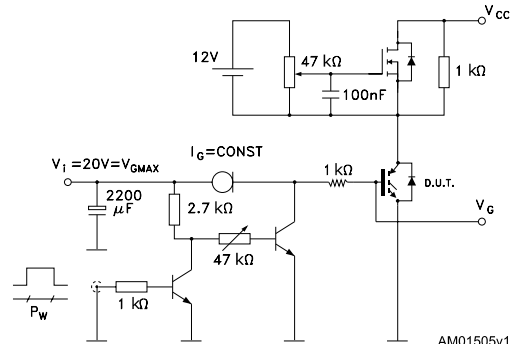
3 Test circuits

Figure 16: Test circuit for inductive load switching



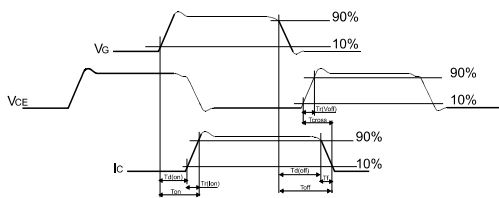
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Figure 17: Gate charge test circuit



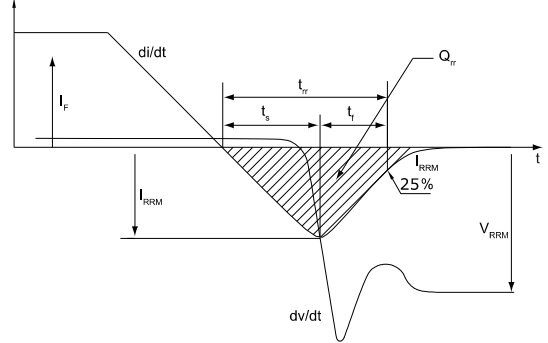
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Figure 18: Switching waveform



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Figure 19: Diode reverse recovery waveform



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4 Topology and pin description

Figure 20: Electrical topology and pin description

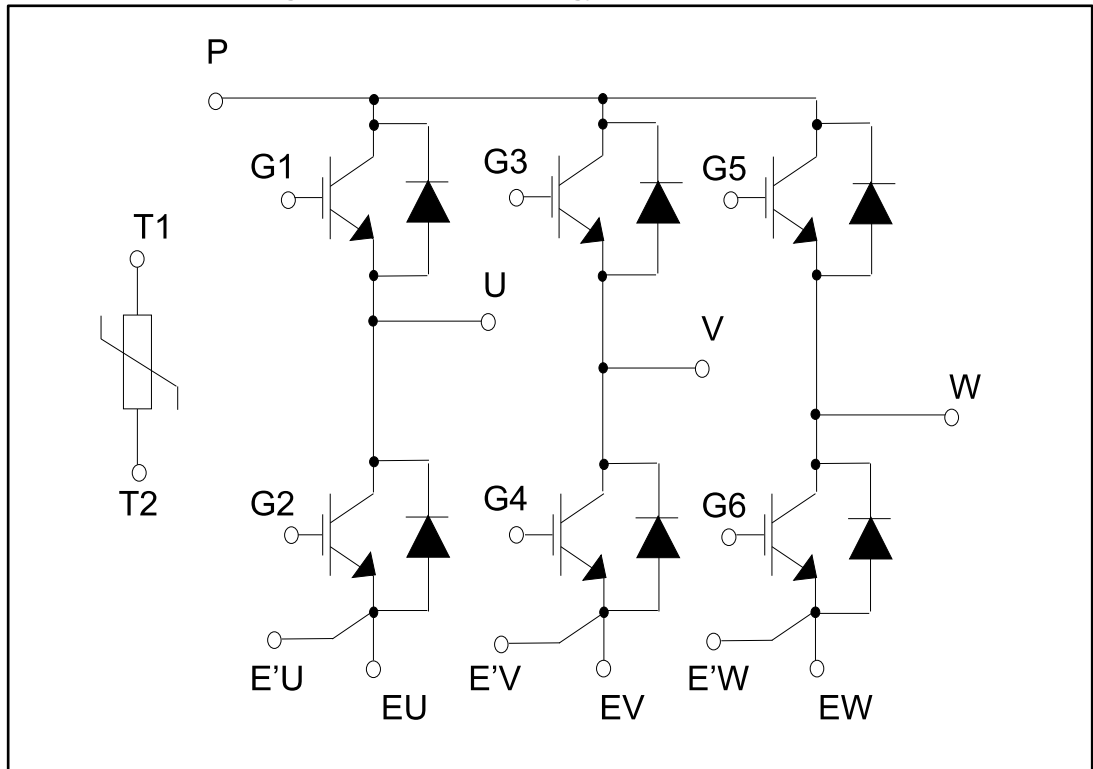
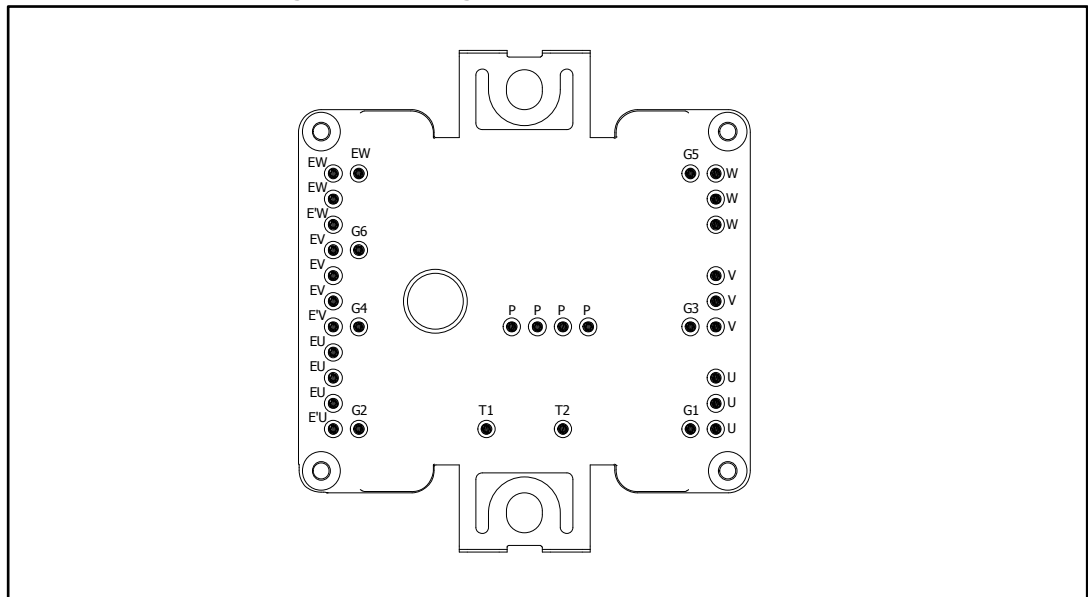


Figure 21: Package top view with sixpack pinout

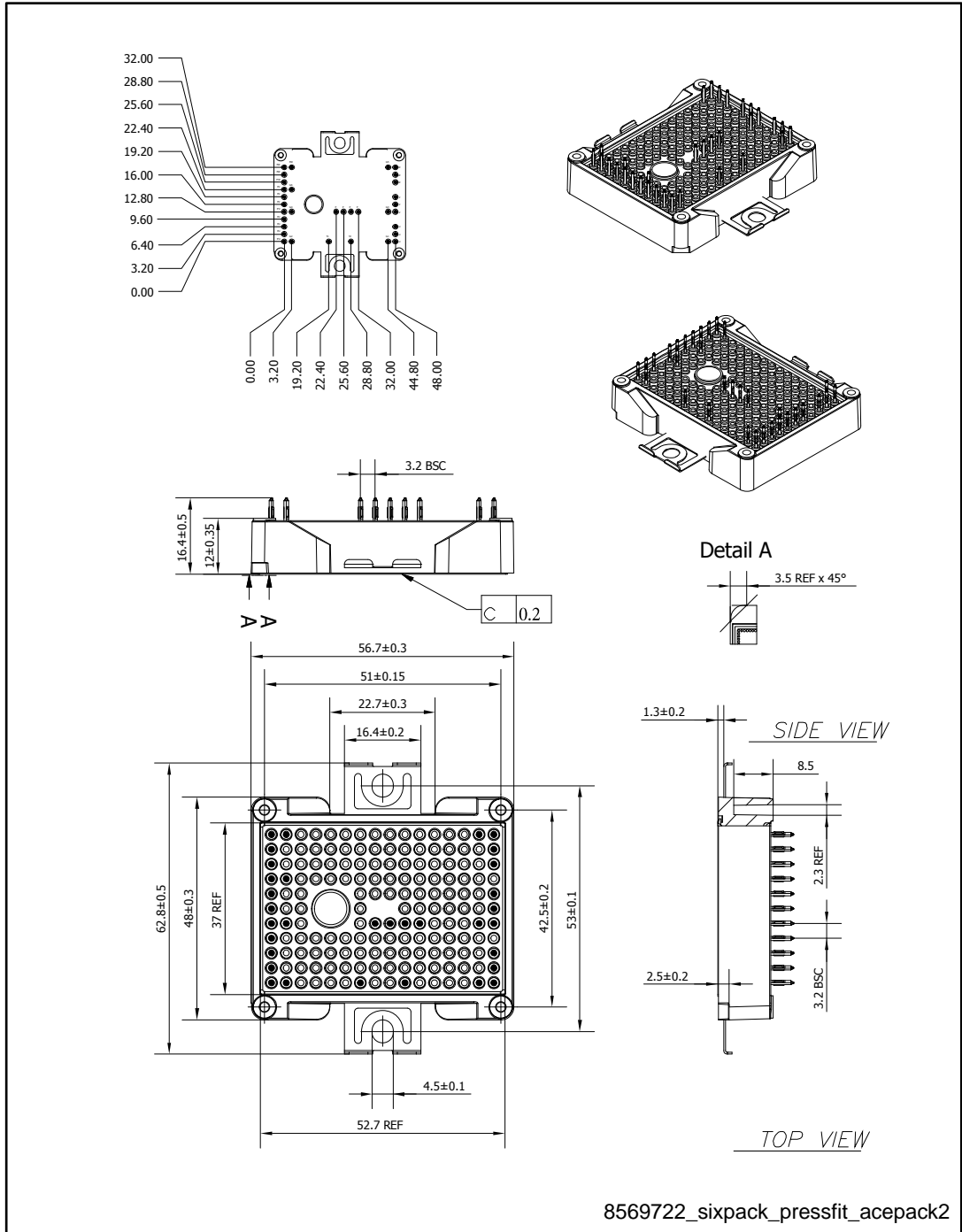


5 Package information

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. ECOPACK® is an ST trademark.

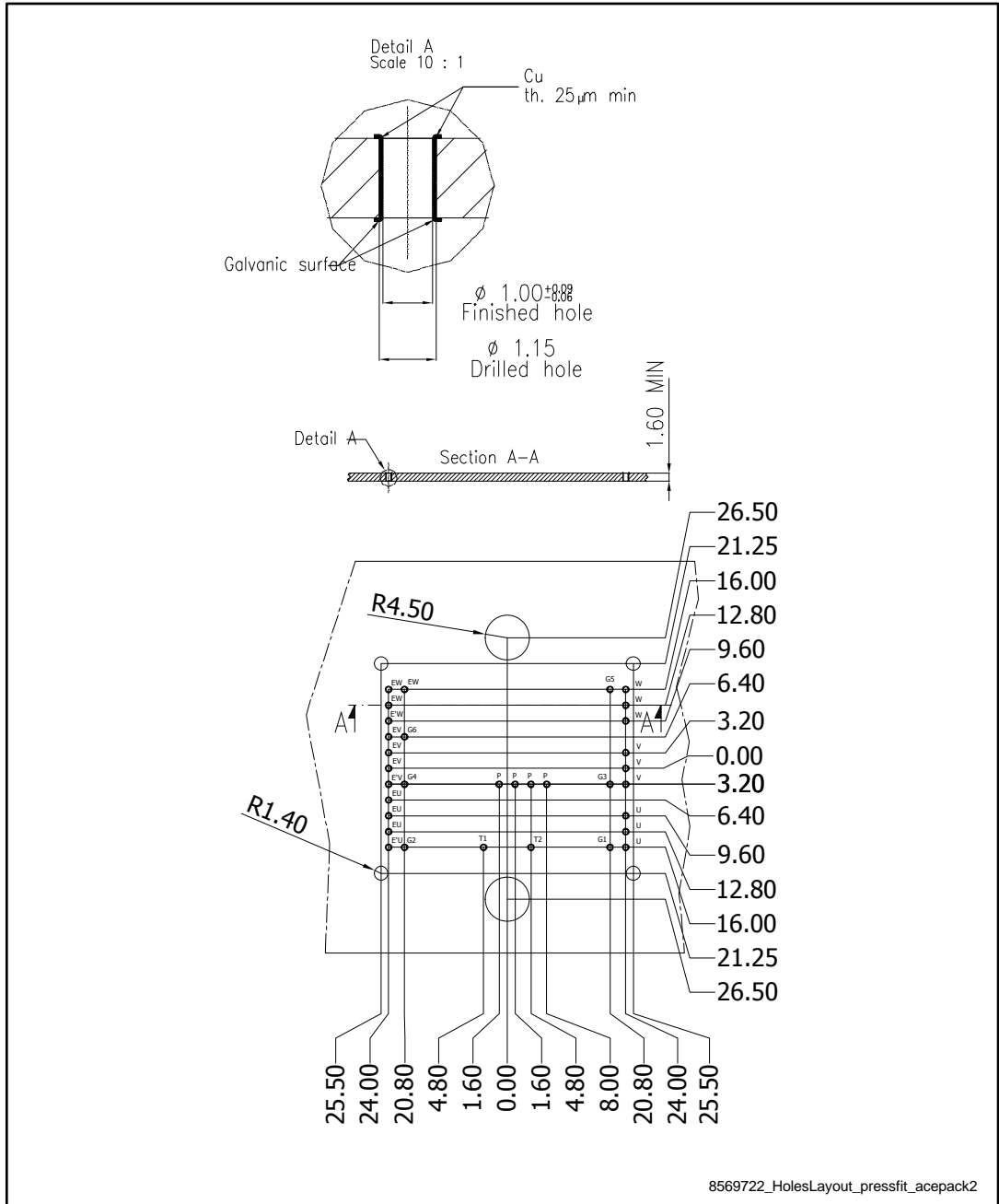
5.1 ACEPACK™ 2 sixpack press fit pins package information

Figure 22: ACEPACK™ 2 sixpack press fit pins package outline (dimensions are in mm)



- The lead size includes the thickness of the lead plating material.
- Dimensions do not include mold protrusion.
- Package dimensions do not include any eventual metal burrs.

Figure 23: ACEPACK™ 2 sixpack press fit pins recommended PCB holes layout
(dimensions are in mm)



6 Revision history

Table 8: Document revision history

Date	Revision	Changes
19-May-2016	1	Initial release.
24-May-2016	2	Updated <i>Table 5: "Electrical characteristics of the diode"</i> .
24-Oct-2017	3	Updated <i>Section 1: "Electrical ratings"</i> , <i>Section 2: "Electrical characteristics curves"</i> and <i>Section 5: "Package information"</i> . Minor text changes.

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