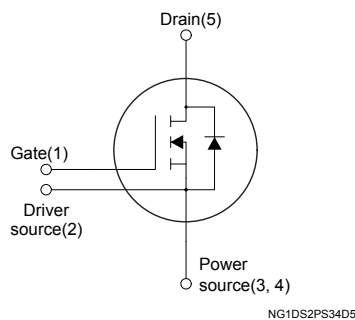
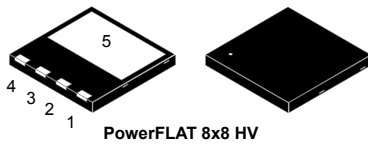


## Silicon carbide Power MOSFET 650 V, 18 mΩ typ., 40 A in a PowerFLAT 8x8 HV package



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
SCTL90N65G2V	650 V	24 mΩ	40 A

- Very fast and robust intrinsic body diode
- Low capacitances
- Source sensing pin for increased efficiency

### Applications

- Switching mode power supply
- DC-DC converters
- Industrial motor control

### Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2<sup>nd</sup> generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.



#### Product status link

[SCTL90N65G2V](#)

#### Product summary

<b>Order code</b>	SCTL90N65G2V
<b>Marking</b>	90N65G2V
<b>Package</b>	PowerFLAT 8x8 HV
<b>Packing</b>	Tape and reel

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	650	V
$V_{GS}$	Gate-source voltage	-10 to 22	V
	Gate-source voltage (recommended operating values)	-5 to 18	
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	40	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	40	
$I_{DM}^{(2)}$	Drain current (pulsed)	160	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	935	W
$T_{stg}$	Storage temperature range	-55 to 175	°C
$T_J$	Operating junction temperature range		°C

1. Value limited by package.
2. Pulse width is limited by safe operating area.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	0.16	°C/W
$R_{thJB}^{(1)}$	Thermal resistance, junction-to-board	45	°C/W

1. When mounted on an 1-inch<sup>2</sup> FR-4, 2 Oz copper board.

## 2 Electrical characteristics

( $T_C = 25\text{ °C}$  unless otherwise specified).

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	650			V
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 650\text{ V}$ , $V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = -10\text{ to }22\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 1\text{ mA}$	1.8	3.2	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}$ , $I_D = 40\text{ A}$		18	24	m $\Omega$
		$V_{GS} = 18\text{ V}$ , $I_D = 40\text{ A}$ , $T_J = 175\text{ °C}$		27		

**Table 4. Dynamic, based on HiP247 package option**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 400\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	3380	-	pF
$C_{oss}$	Output capacitance		-	294	-	pF
$C_{rss}$	Reverse transfer capacitance		-	49	-	pF
$R_g$	Gate input resistance	$f = 1\text{ MHz}$ , $I_D = 0\text{ A}$	-	1	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 400\text{ V}$ , $I_D = 50\text{ A}$ , $V_{GS} = -5\text{ V to }18\text{ V}$	-	157	-	nC
$Q_{gs}$	Gate-source charge		-	43	-	nC
$Q_{gd}$	Gate-drain charge		-	42	-	nC

**Table 5. Switching energy (inductive load), based on HiP247 package option**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}$ , $V_{DD} = 400\text{ V}$ , $I_D = 50\text{ A}$ , $R_G = 2.2\text{ }\Omega$	-	130	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy		-	210	-	$\mu\text{J}$
$E_{on}$	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}$ , $V_{DD} = 400\text{ V}$ , $I_D = 50\text{ A}$ , $R_G = 2.2\text{ }\Omega$ , $T_C = 150\text{ °C}$	-	135	-	$\mu\text{J}$
$E_{off}$	Turn-off switching energy		-	200	-	$\mu\text{J}$

**Table 6. Switching times, based on HiP247 package option**

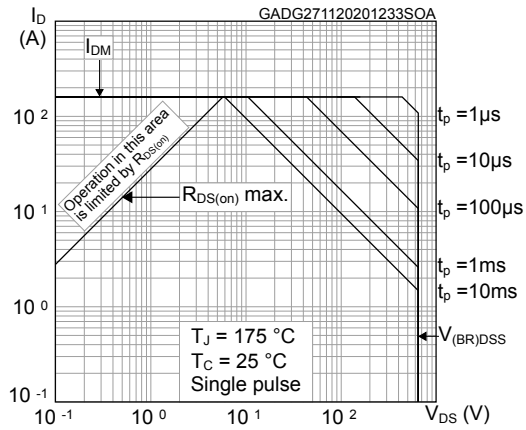
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$ , $I_D = 50\text{ A}$ , $R_G = 2.2\text{ }\Omega$ , $V_{GS} = -5\text{ V to }18\text{ V}$	-	26	-	ns
$t_f$	Fall time		-	16	-	ns
$t_{d(off)}$	Turn-off delay time		-	58	-	ns
$t_r$	Rise time		-	38	-	ns

**Table 7. Reverse SiC diode characteristics, based on HiP247 package option**

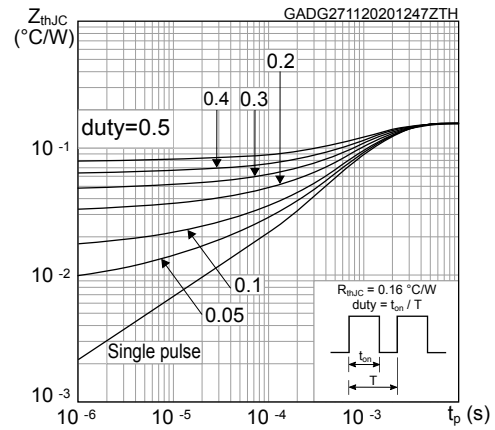
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Forward on voltage	$I_F = 30\text{ A}$ , $V_{GS} = 0\text{ V}$	-	2.5	-	V
$t_{rr}$	Reverse recovery time	$I_F = 50\text{ A}$ , $di/dt = 4000\text{ A}/\mu\text{s}$ , $V_{DD} = 400\text{ V}$	-	17	-	ns
$Q_{rr}$	Reverse recovery charge		-	308	-	nC
$I_{RRM}$	Reverse recovery current		-	30	-	A

## 2.1 Electrical characteristics (curves)

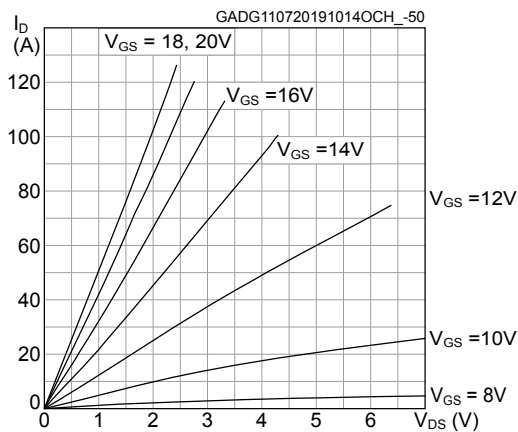
**Figure 1. Safe operating area**



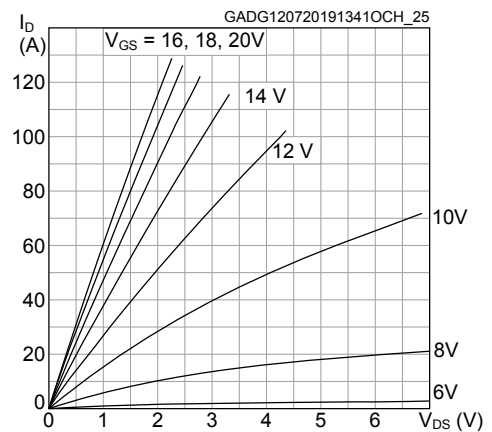
**Figure 2. Maximum transient thermal impedance**



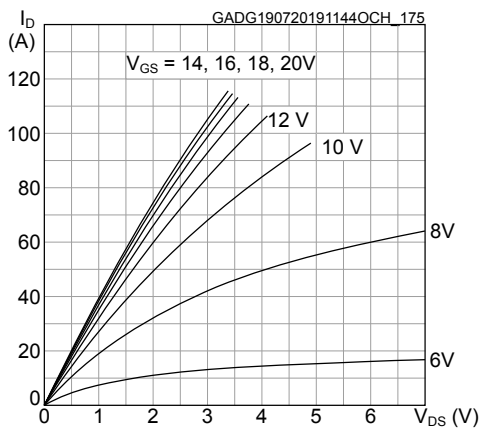
**Figure 3. Typical output characteristics (T<sub>J</sub> = -50 °C)**



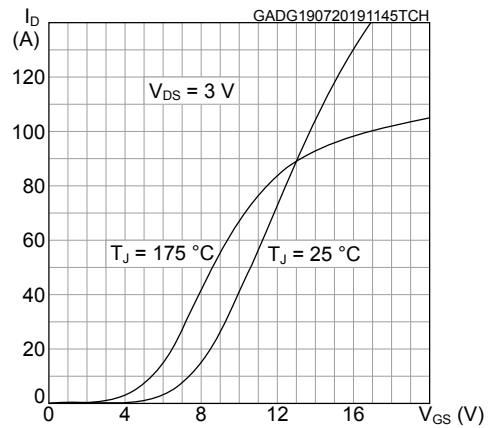
**Figure 4. Typical output characteristics (T<sub>J</sub> = 25 °C)**



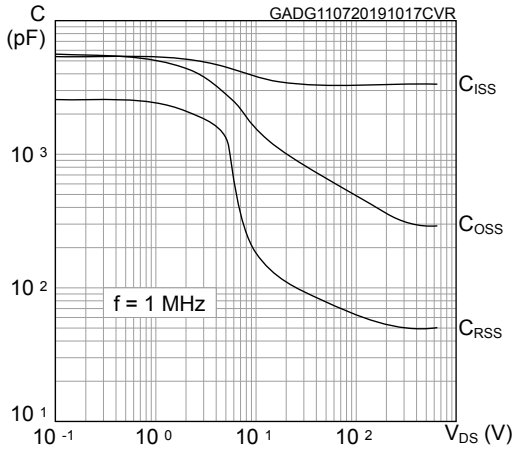
**Figure 5. Typical output characteristics (T<sub>J</sub> = 175 °C)**



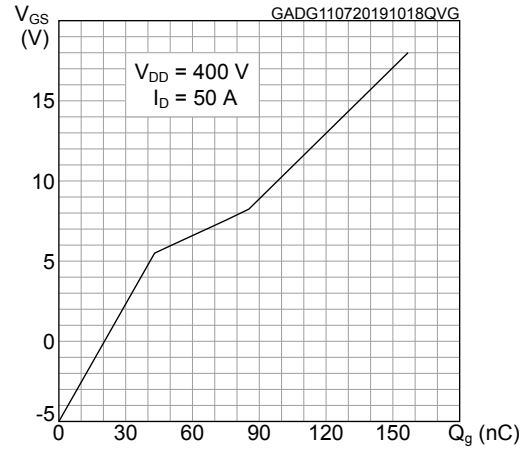
**Figure 6. Typical transfer characteristics**



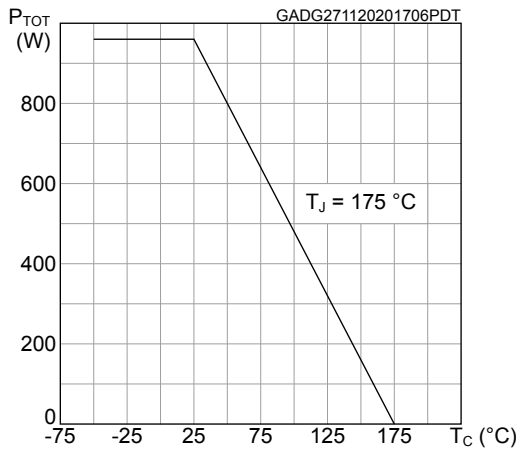
**Figure 7. Typical capacitance characteristics, based on HiP247 package option**



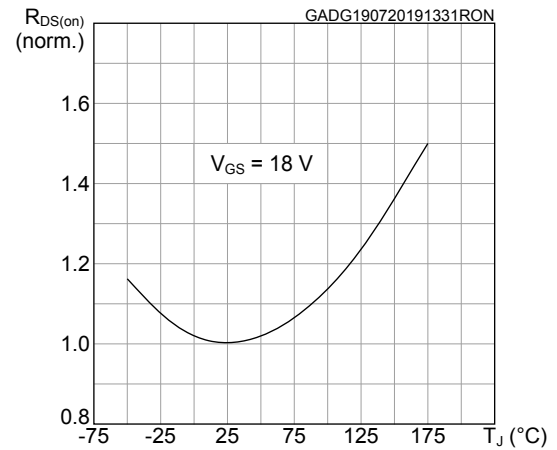
**Figure 8. Typical gate charge characteristics, based on HiP247 package option**



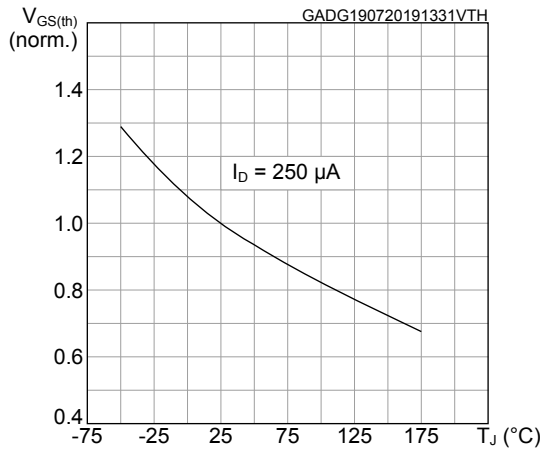
**Figure 9. Total power dissipation**



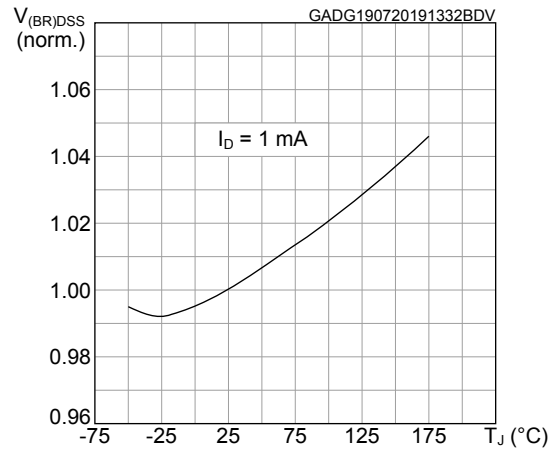
**Figure 10. Normalized on-resistance vs temperature**



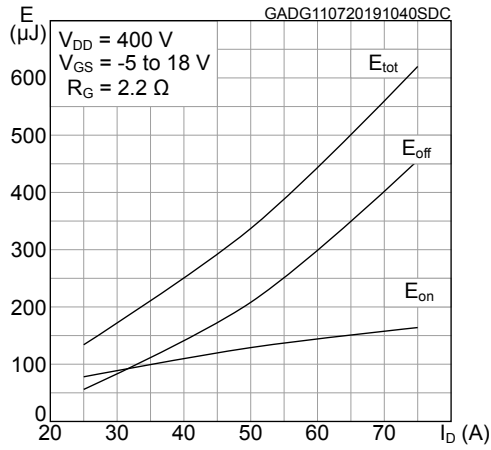
**Figure 11. Normalized gate threshold vs temperature**



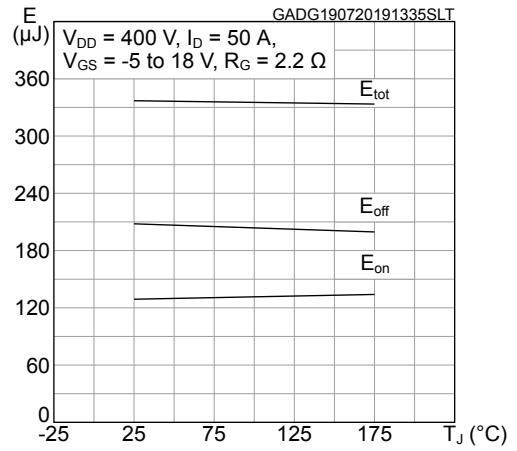
**Figure 12. Normalized breakdown voltage vs temperature**



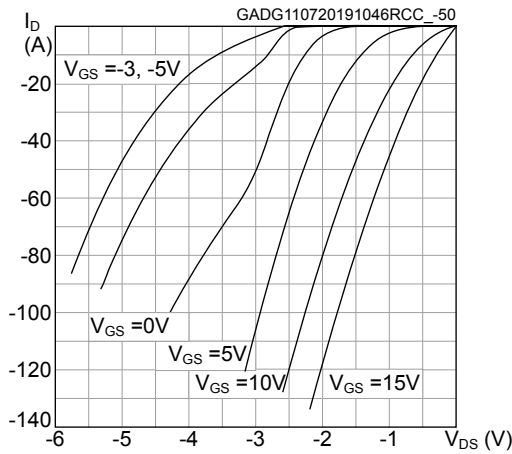
**Figure 13. Typical switching energy vs drain current, based on HiP247 package option**



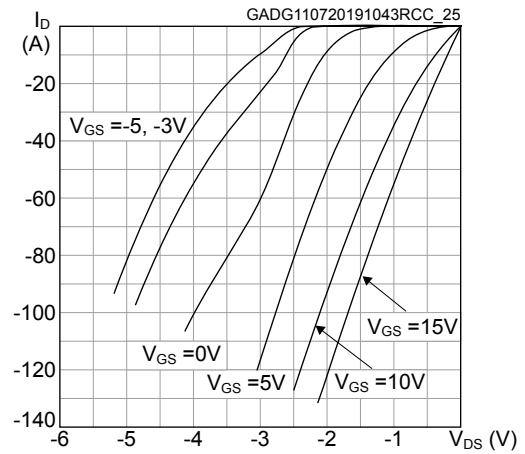
**Figure 14. Typical switching energy vs temperature**



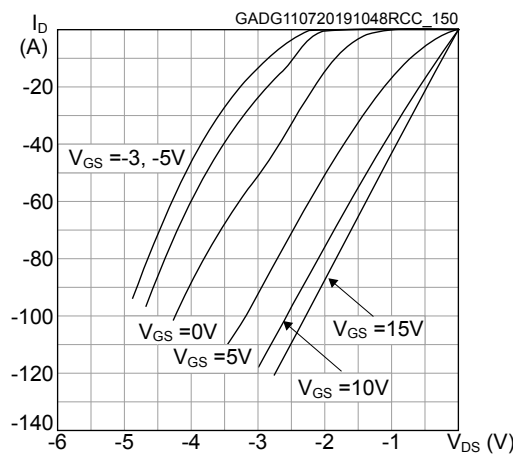
**Figure 15. Typical reverse conduction characteristics (T<sub>J</sub> = -50 °C)**



**Figure 16. Typical reverse conduction characteristics (T<sub>J</sub> = 25 °C)**



**Figure 17. Typical reverse conduction characteristics (T<sub>J</sub> = 150 °C)**

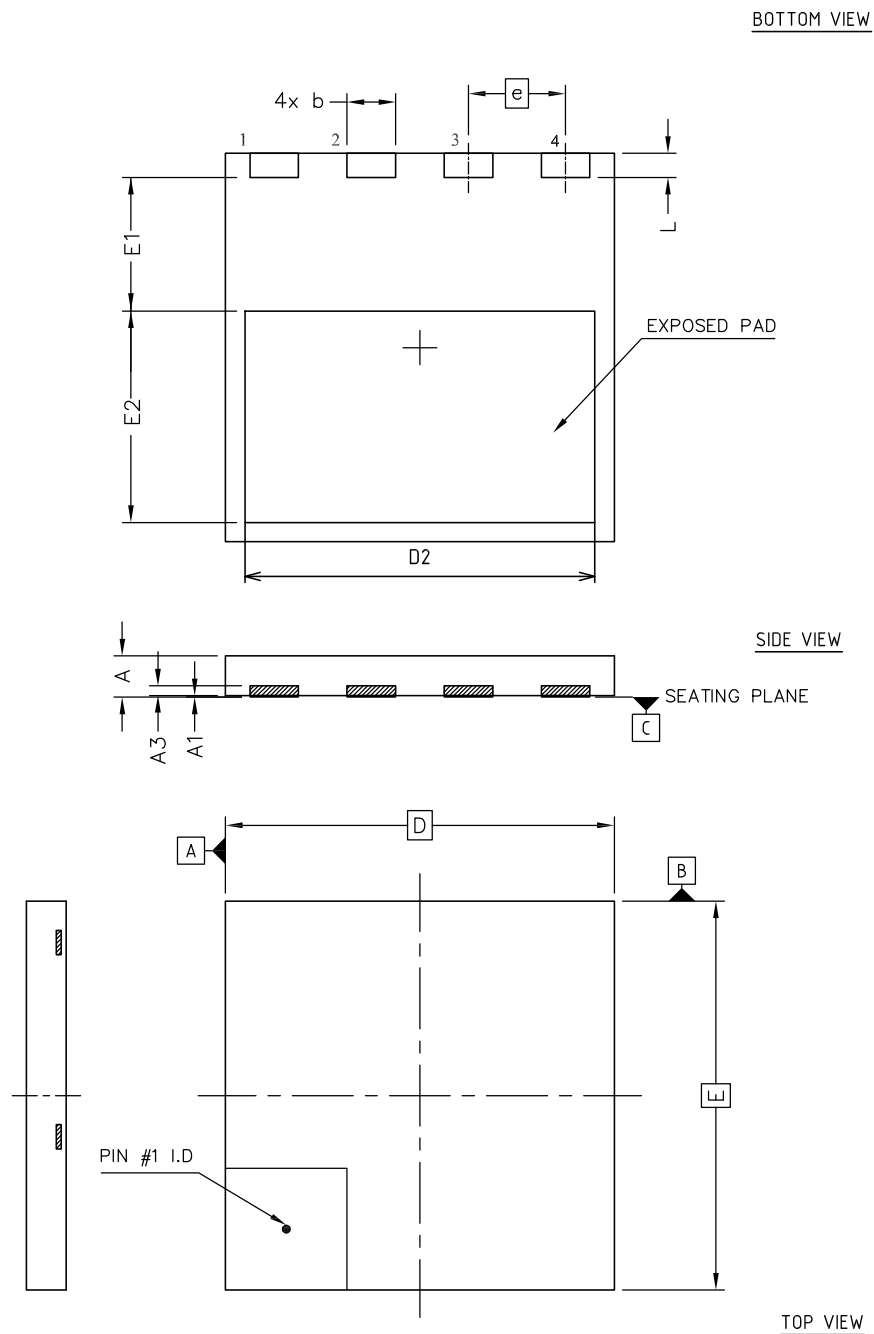


### 3 Package information

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.

#### 3.1 PowerFLAT 8x8 HV type A package information

**Figure 18. PowerFLAT 8x8 HV type A package outline**



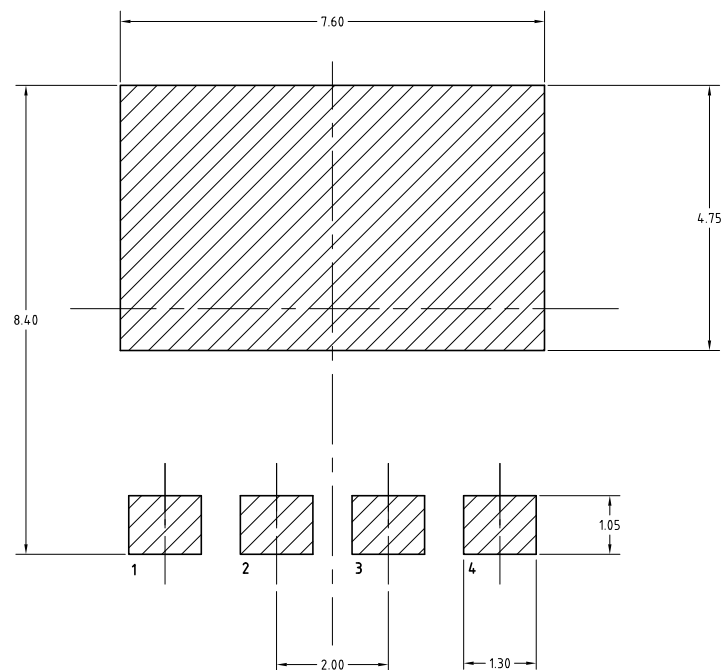
8222871\_Rev\_4



**Table 8. PowerFLAT 8x8 HV type A mechanical data**

Ref.	Dimensions (in mm)		
	Min.	Typ.	Max.
A	0.75	0.85	0.95
A1	0.00		0.05
A3	0.10	0.20	0.30
b	0.90	1.00	1.10
D	7.90	8.00	8.10
E	7.90	8.00	8.10
D2	7.10	7.20	7.30
E1	2.65	2.75	2.85
E2	4.25	4.35	4.45
e	2.00 BSC		
L	0.40	0.50	0.60

**Figure 19. PowerFLAT 8x8 HV footprint**

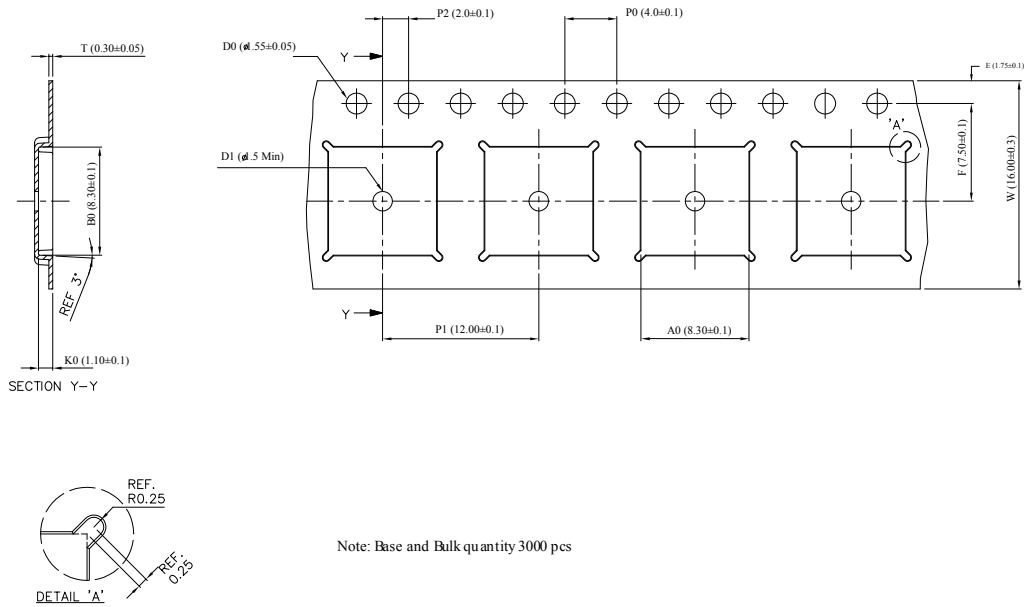


8222871\_REV\_4\_footprint

*Note:* All dimensions are in millimeters.

### 3.2 PowerFLAT 8x8 HV packing information

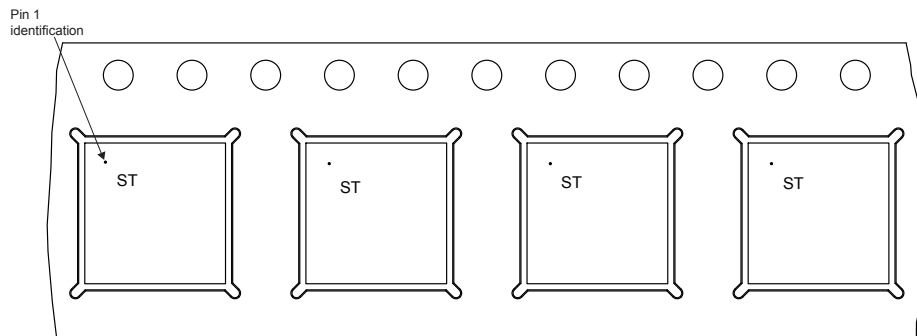
Figure 20. PowerFLAT 8x8 HV tape



8229819\_Tape\_revA

Note: All dimensions are in millimeters.

Figure 21. PowerFLAT 8x8 HV package orientation in carrier tape





## Revision history

**Table 9. Document revision history**

Date	Version	Changes
10-Dec-2020	1	First release.

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