

CG65080TAA



Description

CG65080TAA is a 650V GaN-on-Si enhancement-mode power transistor in TO-Leadless (TOLL) package. The properties of GaN allow for high current, high breakdown voltage and high switching frequency. The TOLL package offers low parasitic resistance/inductance, strong heat dissipation and high solderability, which can fully release device potential and make GaN better apply to industrial applications.

Features

- 650V GaN enhancement-mode power switch
- $R_{DS(on), max}$ 80m Ω
- Recommended gate drive voltage 0V ~ 6V
- Ultra-low FOM
- Ultra-high switching frequency
- Reverse current capability
- Zero reverse recovery loss
- Monolithic integrated ESD protection, HBM class 2, CDM class C3
- RoHS, Pb-free, REACH-compliant

Table 1 Key Performance Parameters at $T_j = 25^\circ\text{C}$

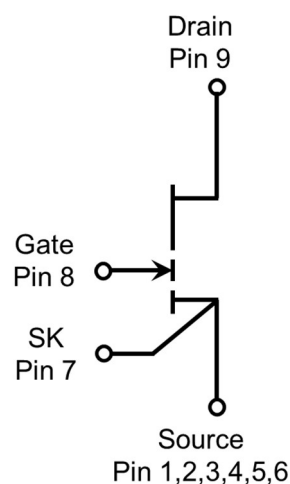
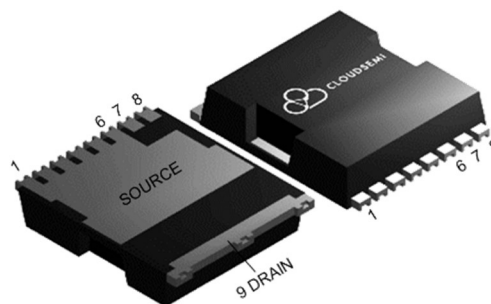
Parameters	Values	Units
$V_{DS, max}$	650	V
$R_{DS(on), max}$	80	m Ω
Q_G, typ	6	nC
$I_D, Pulse$	42	A
$Q_{OSS} @ 400\text{ V}$	60	nC
Q_{rr}	0	nC

Table 2 Ordering Information

Ordering Code	Package	Marking	Packing
CG65080TAA	TOLL	CG65080TAA	Reel

Applications

- AC-DC converters, DC-DC converters
- Bridgeless totem pole PFC, data center, telecom, network SMPS
- Uninterruptable power supplies (UPS)
- Solar inverters, energy storage systems
- On board charger (OBC)
- Charging pile
- Traction inverter
- Industrial motor drives



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1 Maximum ratings

at $T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified. Continuous application of maximum ratings can deteriorate transistor lifetime. For further information, contact CloudSemi sales office.

Table 3 Maximum rating

Parameters	Symbols	Values			Units	Notes/Test Conditions
		Min.	Typ.	Max.		
Drain-source voltage	$V_{DS, \max}$	-	-	650	V	$V_{GS} = 0\text{ V}$, $I_D = 10\text{ }\mu\text{A}$
Drain-source voltage transient ¹	$V_{DS, \text{transient}}$	-	-	850	V	$V_{GS} = 0\text{ V}$, $V_{DS} = 850\text{ V}$
Continuous current, drain-source	I_D	-	-	22	A	$T_c = 25\text{ }^{\circ}\text{C}$
Pulsed current, drain-source ²	$I_{D, \text{pulse}}$	-	-	42	A	$T_c = 25\text{ }^{\circ}\text{C}$; $V_G = 6\text{ V}$
Pulsed current, drain-source ²	$I_{D, \text{pulse}}$	-	-	23	A	$T_c = 125\text{ }^{\circ}\text{C}$; $V_G = 6\text{ V}$
Gate-source voltage, continuous ³	V_{GS}	-7	-	+7	V	$T_j = -55\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$
Gate-source voltage, pulsed	$V_{GS, \text{pulse}}$	-	-	+10	V	$T_j = -55\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$; $t_{\text{Pulse}} = 50\text{ ns}$, $f = 100\text{ kHz}$; open drain
Power dissipation	P_{tot}	-	-	278	W	$T_c = 25\text{ }^{\circ}\text{C}$
Operating temperature	T_j	-55	-	+150	$^{\circ}\text{C}$	
Storage temperature	T_{stg}	-55	-	+150	$^{\circ}\text{C}$	

1. $V_{DS, \text{transient}}$ is intended for surge rating during non-repetitive events, $t_{\text{Pulse}} < 1\text{ }\mu\text{s}$.

2. Pulse width = $10\text{ }\mu\text{s}$.

3. The minimum V_{GS} is clamped by ESD protection circuit.

2 Thermal characteristics

Table 4 Thermal characteristics

Parameters	Symbols	Values			Units	Notes/Test Conditions
		Min.	Typ.	Max.		
Thermal resistance, junction-case	R_{thJC}	-	-	0.45	$^{\circ}\text{C/W}$	
Reflow soldering temperature	T_{sold}	-	-	260	$^{\circ}\text{C}$	MSL3

3 Electrical characteristics

at $T_j = 25\text{ }^{\circ}\text{C}$, unless specified otherwise.

Table 5 Static characteristics

Parameters	Sym.	Values			Units	Notes/Test Conditions
		Min.	Typ.	Max.		
Gate threshold voltage	$V_{GS(TH)}$	1.2	1.7	2.5	V	$I_D = 30\text{ mA}$; $V_{DS} = V_{GS}$; $T_j = 25\text{ }^{\circ}\text{C}$
		-	1.6	-		$I_D = 30\text{ mA}$; $V_{DS} = V_{GS}$; $T_j = 125\text{ }^{\circ}\text{C}$
Drain-source leakage current	I_{DSS}	-	5	65	μA	$V_{DS} = 650\text{ V}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$
		-	100	-		$V_{DS} = 650\text{ V}$; $V_{GS} = 0\text{ V}$; $T_j = 125\text{ }^{\circ}\text{C}$
Gate-source leakage current	I_{GSS}	-	163	-	μA	$V_{GS} = 6\text{ V}$; $V_{DS} = 0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	70	80	$\text{m}\Omega$	$V_{GS} = 6\text{ V}$; $I_D = 8\text{ A}$; $T_j = 25\text{ }^{\circ}\text{C}$
		-	135	-	$\text{m}\Omega$	$V_{GS} = 6\text{ V}$; $I_D = 8\text{ A}$; $T_j = 125\text{ }^{\circ}\text{C}$
Gate resistance	R_G	-	1.5	-	Ω	$f = 5\text{ MHz}$; open drain

Table 6 Dynamic characteristics

Parameters	Sym.	Values			Units	Notes/Test Conditions
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	230	-	pF	$V_{GS} = 0\text{ V}$; $V_{DS} = 400\text{ V}$; $f = 1\text{ MHz}$
Output capacitance	C_{oss}	-	71	-	pF	$V_{GS} = 0\text{ V}$; $V_{DS} = 400\text{ V}$; $f = 1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	0.13	-	pF	$V_{GS} = 0\text{ V}$; $V_{DS} = 400\text{ V}$; $f = 1\text{ MHz}$
Effective output capacitance, energy related ¹	$C_{o(er)}$	-	98	-	pF	$V_{GS} = 0\text{ V}$; $V_{DS} = 0\text{ to }400\text{ V}$
Effective output capacitance, time related ²	$C_{o(tr)}$	-	152	-	pF	$V_{GS} = 0\text{ V}$; $V_{DS} = 0\text{ to }400\text{ V}$
Output charge	Q_{oss}	-	60	-	nC	$V_{GS} = 0\text{ V}$; $V_{DS} = 0\text{ to }400\text{ V}$
Turn-on delay time	$t_{d(on)}$	-	3.8	-	ns	$V_{DS} = 400\text{ V}$; $I_D = 6\text{ A}$; $L = 120\text{ }\mu\text{H}$; $V_{GS} = 6\text{ V}$; $R_{on} = 10\text{ }\Omega$; $R_{off} = 1\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	7.5	-	ns	
Rise time	t_r	-	5.0	-	ns	
Fall time	t_f	-	10.2	-	ns	
Switching Energy during turn-on	E_{on}	-	45	-	μJ	
Switching Energy during turn-off	E_{off}	-	8	-	μJ	

1. $C_{o(er)}$ is the fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400 V.

2. $C_{o(tr)}$ is the fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400 V.

Table 7 Gate charge characteristics

Parameters	Sym.	Values			Units	Notes/Test Conditions
		Min.	Typ.	Max.		
Gate charge	Q_G	-	6	-	nC	$V_{GS} = 0 \text{ to } 6 \text{ V}; V_{DS} = 400 \text{ V};$ $I_D = 8 \text{ A}$
Gate-source charge	Q_{GS}	-	0.5	-	nC	
Gate-drain charge	Q_{GD}	-	2	-	nC	
Gate plateau voltage	V_{Plat}	-	2.2	-	V	$V_{DS} = 400 \text{ V}; I_D = 8 \text{ A}$

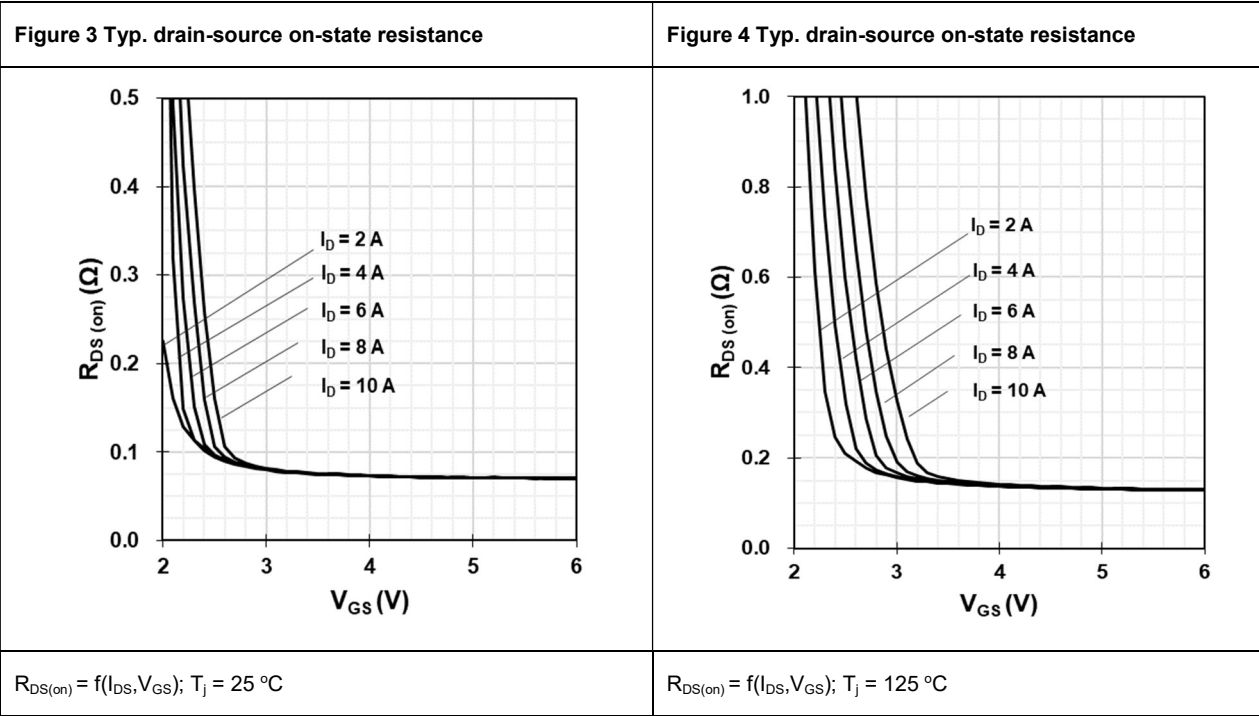
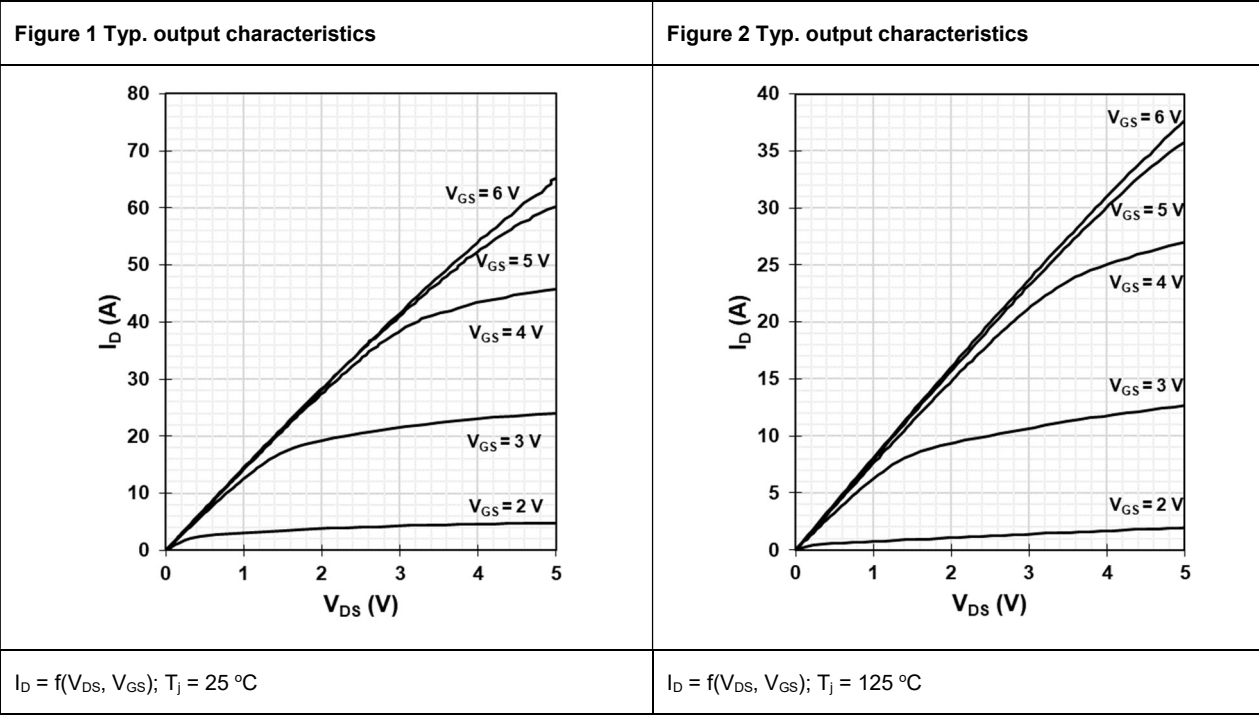
Table 8 Reverse conduction characteristics

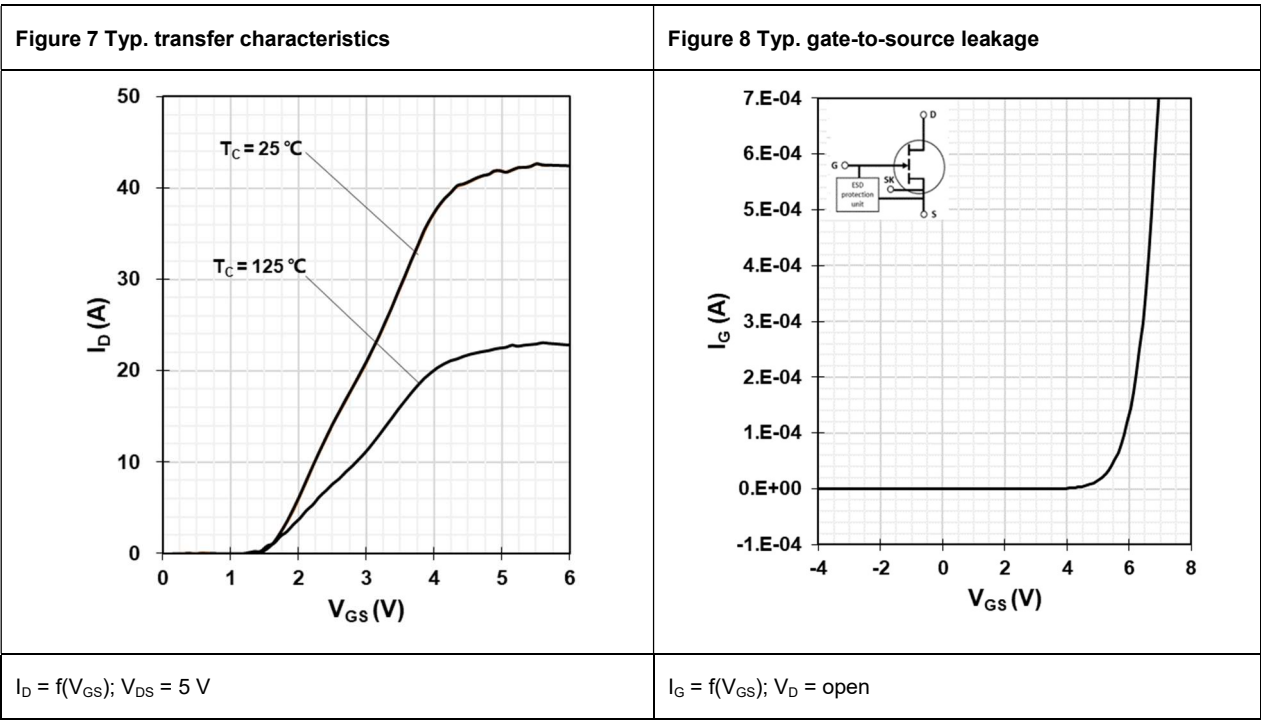
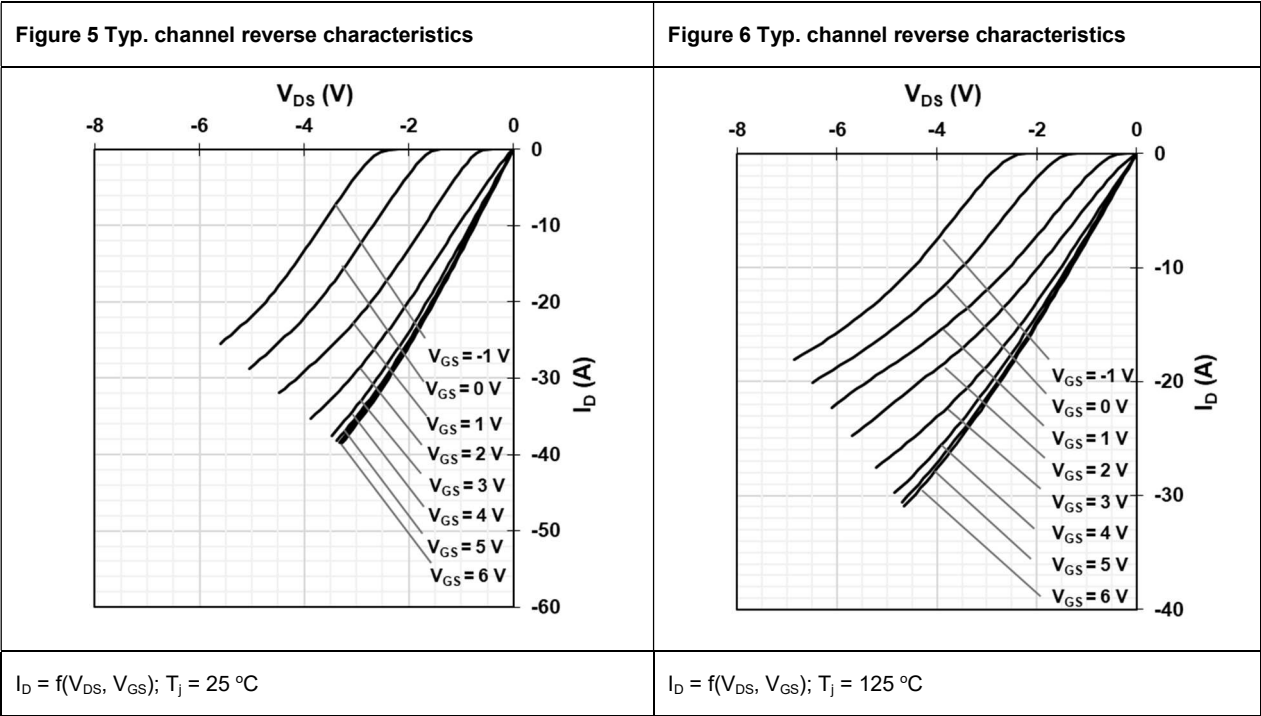
Parameters	Sym.	Values			Units	Notes/Test Conditions
		Min.	Typ.	Max.		
Source-drain reverse voltage	V_{SD}	-	2.3	-	V	$V_{GS} = 0 \text{ V}; I_{SD} = 8 \text{ A}$
Pulsed current, reverse	$I_{S, pulse}$	-	42	-	A	$V_{GS} = 6 \text{ V}$
Reverse recovery charge ¹	Q_{rr}	-	0	-	nC	$I_{SD} = 8 \text{ A}; V_{DS} = 400 \text{ V}$
Reverse recovery time	t_{rr}	-	0	-	ns	
Peak reverse recovery current	I_{rrm}	-	0	-	A	

1. Excluding Q_{OSS}

4 Electrical characteristics diagrams

at $T_j = 25\text{ }^{\circ}\text{C}$, unless specified otherwise.





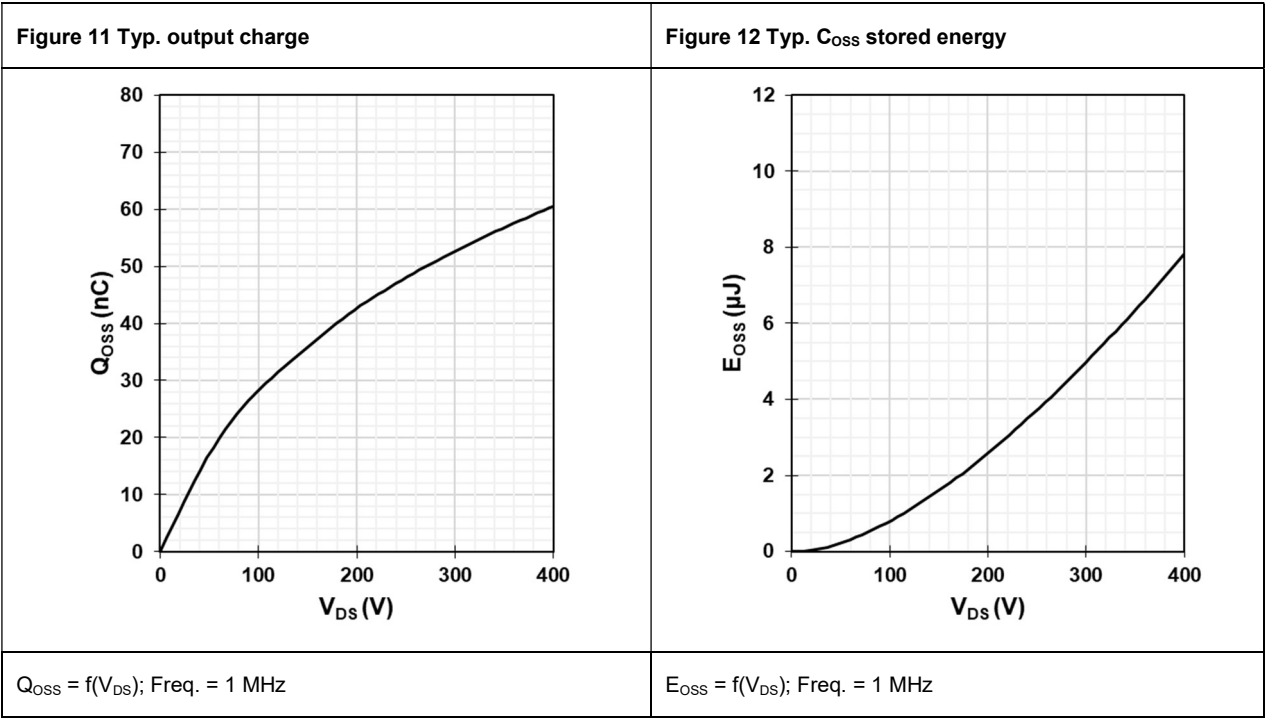
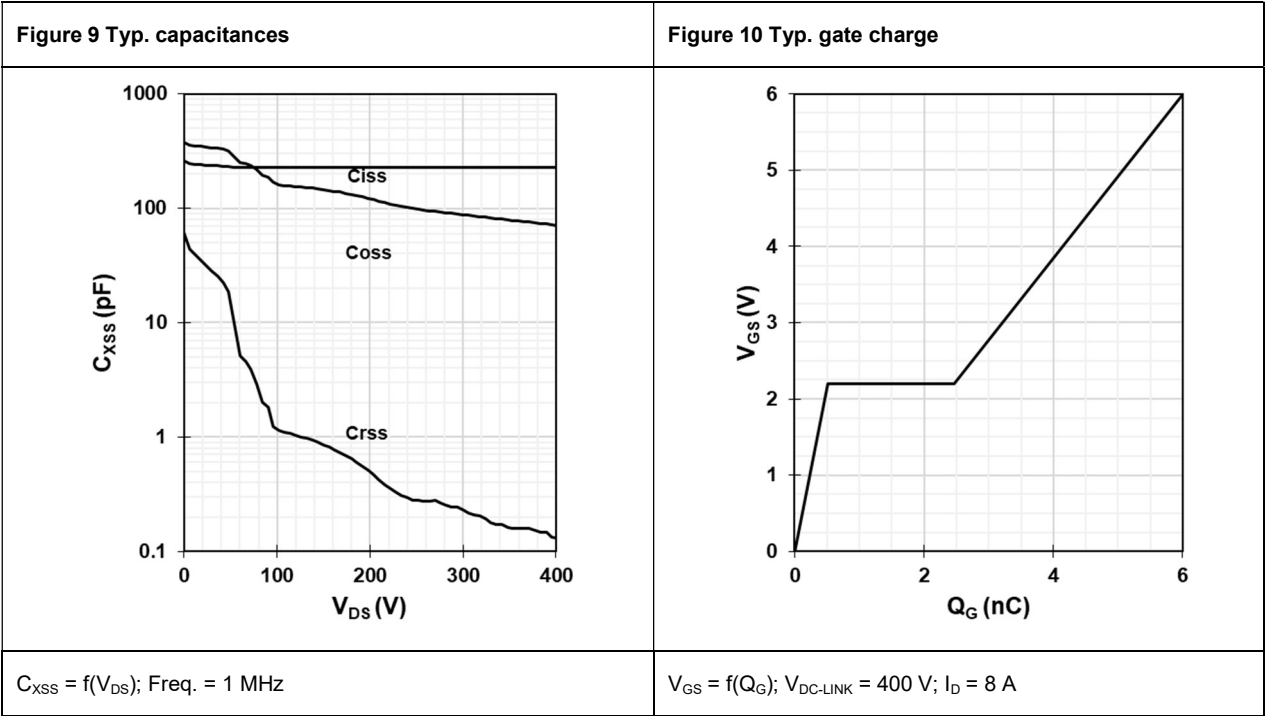


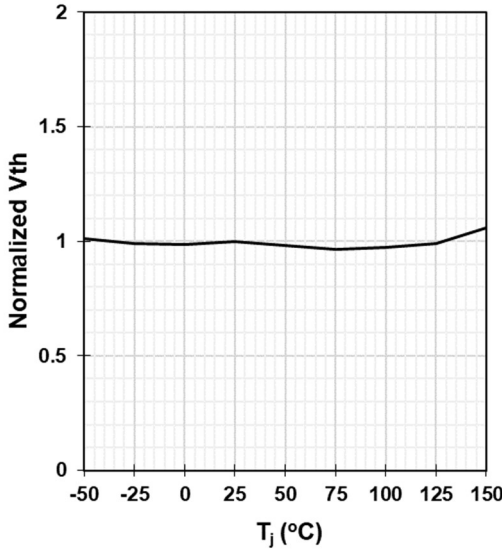
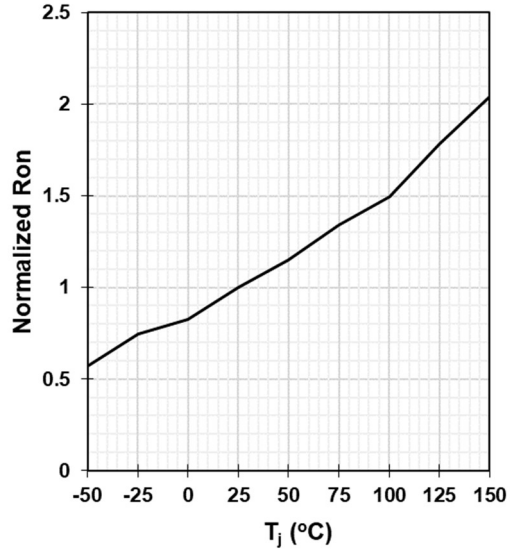
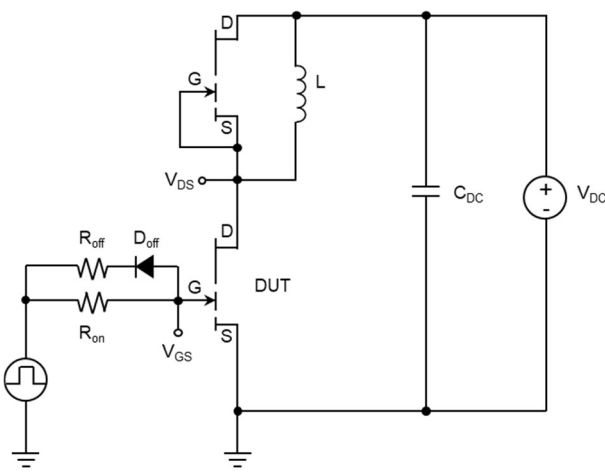
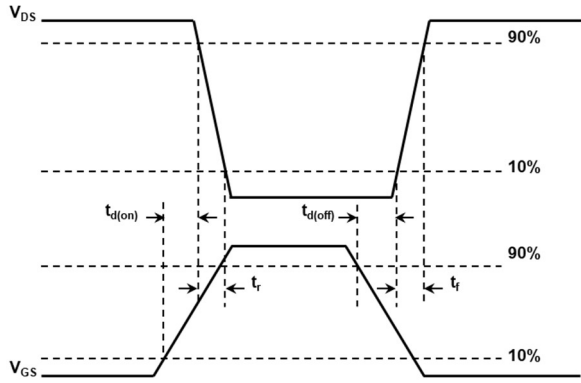
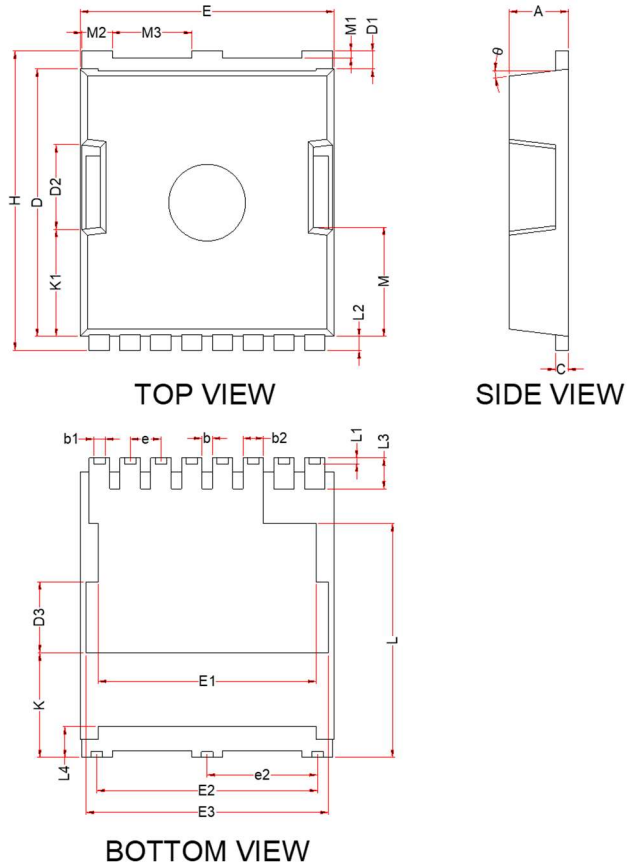
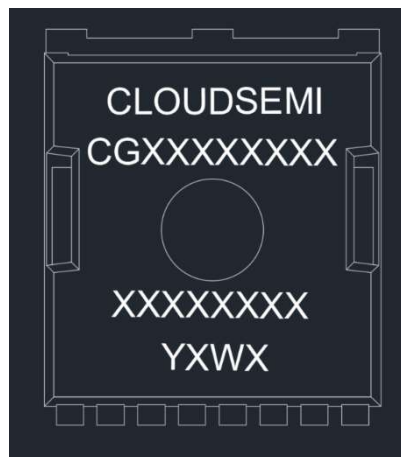
Figure 13 Gate threshold voltage	Figure 14 Drain-source on-state resistance
	
$V_{TH} = f(T_j); V_{GS} = V_{DS}; I_D = 30\text{ mA}$	$R_{DS(on)} = f(T_j); I_D = 8\text{ A}; V_{GS} = 6\text{ V}$

Figure 15 Switching time test circuit	Figure 16 Typ. switching time waveform
	
$V_{DS} = 400\text{ V}, I_D = 6\text{ A}, L = 120\text{ }\mu\text{H}, V_{GS} = 6\text{ V},$ $R_{on} = 10\text{ }\Omega, R_{off} = 1\text{ }\Omega$	

5 Package outlines

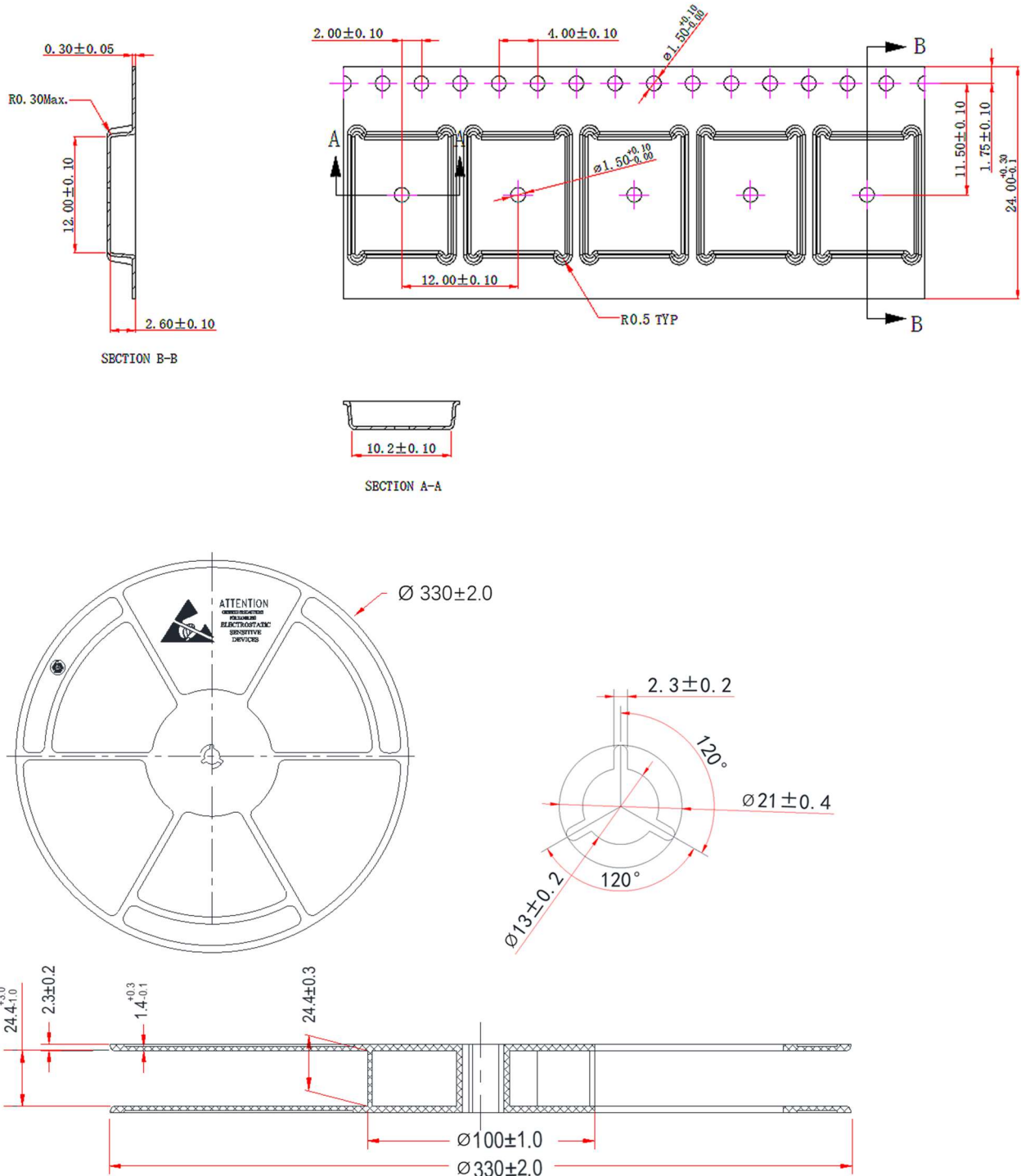


SYMBOL	MIN	MAX
A	2.20	2.40
b	0.30	0.50
b1	0.35	0.55
b2	0.70	0.90
c	0.40	0.60
D	10.28	10.58
D1	0.60	0.80
D2	(3.30)	
D3	(2.77)	
E	9.70	10.10
E1	(8.50)	
E2	(8.50)	
E3	(9.46)	
e	1.10	1.30
H	11.48	11.88
K	(4.08)	
K1	(4.17)	
L	(9.13)	
L1	0.13	0.33
L2	0.50	0.70
L3	1.10	1.30
L4	1.10	1.30
M	(4.23)	
M1	0.16	0.36
M2	1.10	1.30
M3	3.00	3.20
θ	4°	10°
e2	4.20	4.40



Row	Description	Example
Row 1	Company name	CLOUDSEMI
Row 2	Device name	CGXXXXXXXX
Row 3	ASSY lot No.	XXXXXXXX
Row 4	Year & Week	YXWX

6 Tape and reel information



7 Revision history

Major changes since the last revision

Revision	Date	Description of changes
1.0	2023-11-23	1.0 version release