

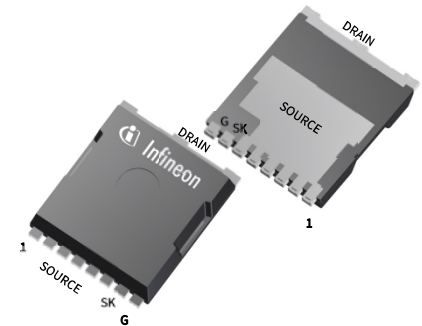
# IGT40R070D1 E8220

## 400V CoolGaN™ enhancement-mode Power Transistor

The 400V CoolGaN™ family is the derivative of industry benchmark 600V CoolGaN™ technology, optimized for Class-D Audio amplifier applications.

### Features

- Enhancement mode transistor – Normally OFF switch
- Ultra fast switching
- No reverse-recovery charge
- Capable of reverse conduction
- Low gate charge, low output charge
- Superior commutation ruggedness
- Qualified according to JEDEC Standards (JESD47 and JESD22)



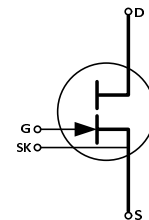
Gate	8
Drain	drain contact
Kelvin Source	7
Source	1,2,3,4,5,6

### Benefits

- Improves efficiency due to best Figure Of Merit (FOM) in 400V class
- Exhibits very low noise level
- Lower THD compared to best-in-class Silicon switch
- Compatible with existing control ICs

### Applications

- Class-D Audio Amplifier



**Table 1 Key Performance Parameters at T<sub>j</sub> = 25 °C**

Parameter	Value	Unit
V <sub>DS,max</sub>	400	V
R <sub>DS(on),max</sub>	70	mΩ
Q <sub>G,typ</sub>	4.5	nC
I <sub>D,pulse</sub>	60	A
Q <sub>oss @ 320 V</sub>	35	nC
Q <sub>rr</sub>	0	nC



**Table 2 Ordering Information**

Type / Ordering Code	Package	Marking	Related links
IGT40R070D1 E8220	PG-HSOF-8	40L070D1	NA

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## 1 Maximum ratings

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

Continuous application of maximum ratings can deteriorate transistor lifetime. For further information, contact your local Infineon sales office.

**Table 3** Maximum ratings

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Drain Source Voltage <sup>1</sup>	$V_{DS,max}$	-	-	400	V	$V_{GS} = 0\text{ V}$
Continuous current, drain source	$I_D$	-	-	31	A	$T_C = 25\text{ °C}; T_j = T_{j,max}$
		-	-	20		$T_C = 100\text{ °C}; T_j = T_{j,max}$
		-	-	14		$T_C = 125\text{ °C}; T_j = T_{j,max}$
Pulsed current, drain source <sup>2 3</sup>	$I_{D,pulse}$	-	-	60	A	$T_C = 25\text{ °C}; I_G = 26.1\text{ mA}$ ; See Figure 3; Figure 21;
Pulsed current, drain source <sup>3 4</sup>	$I_{D,pulse}$	-	-	35	A	$T_C = 125\text{ °C}; I_G = 26.1\text{ mA}$ ; See Figure 4; Figure 22;
Gate current, continuous <sup>4 5</sup>	$I_G$	-	-	20	mA	$T_j = 0\text{ °C}$ to $150\text{ °C}$ ; Refer to gate drive app note
Gate current, pulsed <sup>5</sup>	$I_{G,pulse}$	-	-	2000	mA	$T_j = 0\text{ °C}$ to $150\text{ °C}$ ; $t_{PULSE} = 50\text{ ns}$ , $f = 100\text{ kHz}$ Refer to gate drive app note
Gate source voltage, continuous <sup>5</sup>	$V_{GS}$	-10	-	-	V	$T_j = 0\text{ °C}$ to $150\text{ °C}$ ; Refer to gate drive app note
Gate source voltage, pulsed <sup>5</sup>	$V_{GS,pulse}$	-25	-	-	V	$T_j = 0\text{ °C}$ to $150\text{ °C}$ ; $t_{PULSE} = 50\text{ ns}$ , $f = 100\text{ kHz}$ ; open drain Refer to gate drive app note
Power dissipation	$P_{tot}$	-	-	125	W	$T_C = 25\text{ °C}$
Operating temperature	$T_j$	0	-	150	°C	
Storage temperature	$T_{stg}$	0	-	150	°C	Max shelf life depends on storage conditions.
Drain-source voltage slew-rate	$dV/dt$			200	V/ns	

<sup>1</sup> All devices are 100% tested at  $I_{DS} = 12.2\text{ mA}$  to assure  $V_{DS} \geq 800\text{ V}$

<sup>2</sup> Limits derived from product characterization, parameter not measured during production

<sup>3</sup> Ensure that average gate drive current,  $I_G$  is  $\leq 20\text{ mA}$

<sup>4</sup> Parameter is influenced by rel-requirements. Please contact the local Infineon Sales Office to get an assessment of your application.

<sup>5</sup> We recommend using an advanced driving technique to optimize the device performance. Please see application information for details.

## 2 Thermal characteristics

Table 4 Thermal characteristics

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction-case	$R_{thJC}$	-	-	1	°C/W	
Thermal resistance, junction-ambient	$R_{thJA}$	-	-	62	°C/W	Device on PCB, minimum footprint
Thermal resistance, junction-ambient for SMD version	$R_{thJA}$	-	35	45	°C/W	Device on 40mm*40mm* 1.5mm epoxy PCB FR4 with 6cm <sup>2</sup> (one layer, 70µm thickness) copper area for drain connection and cooling. PCB is vertical without air stream cooling.
Reflow soldering temperature	$T_{sold}$	-	-	245	°C	MSL3

### 3 Electrical characteristics

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

**Table 5 Static characteristics**

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Gate threshold voltage	$V_{GS(th)}$	0.9 0.7	1.2 1.0	1.6 1.4	V	$I_{DS} = 2.6\text{ mA}; V_{DS} = 10\text{ V}; T_j = 25\text{ °C}$ $I_{DS} = 2.6\text{ mA}; V_{DS} = 10\text{ V}; T_j = 125\text{ °C}$
Drain-Source leakage current	$I_{DSS}$	- -	1 20	100 -	$\mu\text{A}$	$V_{DS} = 400\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}$ $V_{DS} = 400\text{ V}; V_{GS} = 0\text{ V}; T_j = 150\text{ °C}$
Drain-Source leakage current at application conditions <sup>1</sup>	$I_{DSSapp}$	-	60	-	$\mu\text{A}$	$V_{DS} = 320\text{ V}; V_{GS} = 0\text{ V}; T_j = 125\text{ °C}$
Gate-Source leakage current	$I_{GSS}$	-1 -1	- -	- -	mA	$V_{DS} = 0\text{ V}; V_{GS} = -10\text{ V}; T_j = 25\text{ °C}$ $V_{DS} = 0\text{ V}; V_{GS} = -10\text{ V}; T_j = 125\text{ °C}$
Drain-Source on-state resistance	$R_{DS(on)}$	- -	0.055 0.100	0.070 -	$\Omega$	$I_G = 26.1\text{ mA}; I_D = 8\text{ A}; T_j = 25\text{ °C}$ $I_G = 26.1\text{ mA}; I_D = 8\text{ A}; T_j = 150\text{ °C}$
Gate resistance	$R_{G,int}$	-	0.68	-	$\Omega$	LCR impedance measurement; $f = f_{res}$ ; open drain;

**Table 6 Dynamic characteristics**

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Input capacitance	$C_{iss}$	-	382	-	pF	$V_{GS} = 0\text{ V}; V_{DS} = 320\text{ V};$ $f = 1\text{ MHz}$
Output capacitance	$C_{oss}$	-	72	-	pF	$V_{GS} = 0\text{ V}; V_{DS} = 320\text{ V};$ $f = 1\text{ MHz}$
Reverse Transfer capacitance	$C_{rss}$	-	0.3	-	pF	$V_{GS} = 0\text{ V}; V_{DS} = 320\text{ V};$ $f = 1\text{ MHz}$
Effective output capacitance, energy related <sup>2</sup>	$C_{o(er)}$	-	84	-	pF	$V_{DS} = 0\text{ to }320\text{ V}$
Effective output capacitance, time related <sup>3</sup>	$C_{o(tr)}$	-	109.4	-	pF	$V_{GS} = 0\text{ V}; V_{DS} = 0\text{ to }320\text{ V};$ $I_D = \text{const}$
Output charge	$Q_{oss}$	-	35	-	nC	$V_{DS} = 0\text{ to }320\text{ V}$
Turn- on delay time	$t_{d(on)}$	-	11	-	ns	see Figure 23
Turn- off delay time	$t_{d(off)}$	-	11	-	ns	see Figure 23
Rise time	$t_r$	-	7.5	-	ns	see Figure 23
Fall time	$t_f$	-	9	-	ns	see Figure 23

<sup>1</sup> Parameter represents end of use leakage in applications

<sup>2</sup>  $C_{o(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 320 V

<sup>3</sup>  $C_{o(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 320 V

**Table 7 Gate charge characteristics**

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Gate charge	$Q_G$	-	4.5	-	nC	$I_{GS} = 0$ to 10 mA; $V_{DS} = 320$ V; $I_D = 8$ A

**Table 8 Reverse conduction characteristics**

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Source-Drain reverse voltage	$V_{SD}$	-	2.0	2.5	V	$V_{GS} = 0$ V; $I_{SD} = 8$ A
Pulsed current, reverse	$I_{S,pulse}$	-	-	60	A	$I_G = 26.1$ mA
Reverse recovery charge	$Q_{rr}^1$	-	0	-	nC	$I_S = 8$ A, $V_{DS} = 320$ V
Reverse recovery time	$t_{rr}$	-	0	-	ns	
Peak reverse recovery current	$I_{rrm}$	-	0	-	A	

## 4 Electrical characteristics diagrams

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

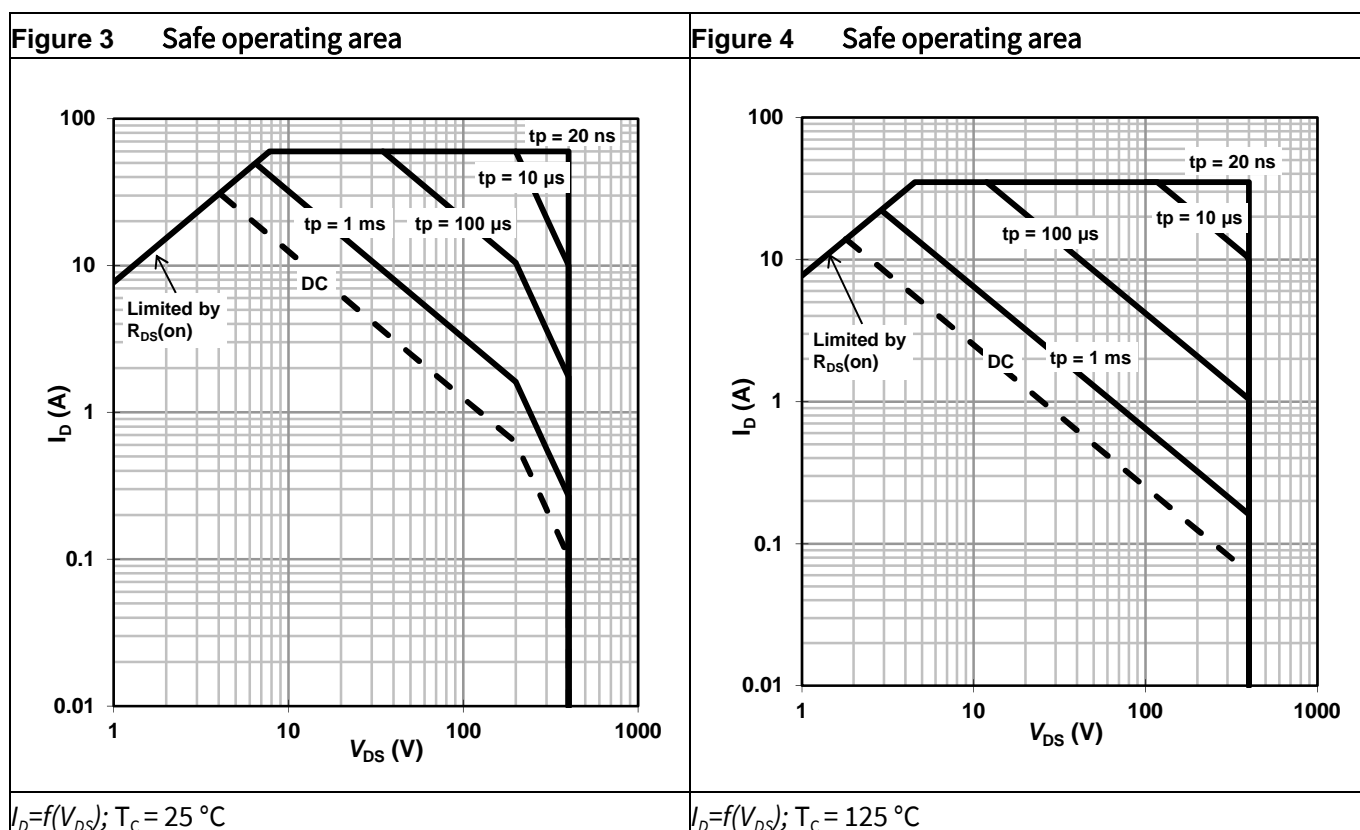
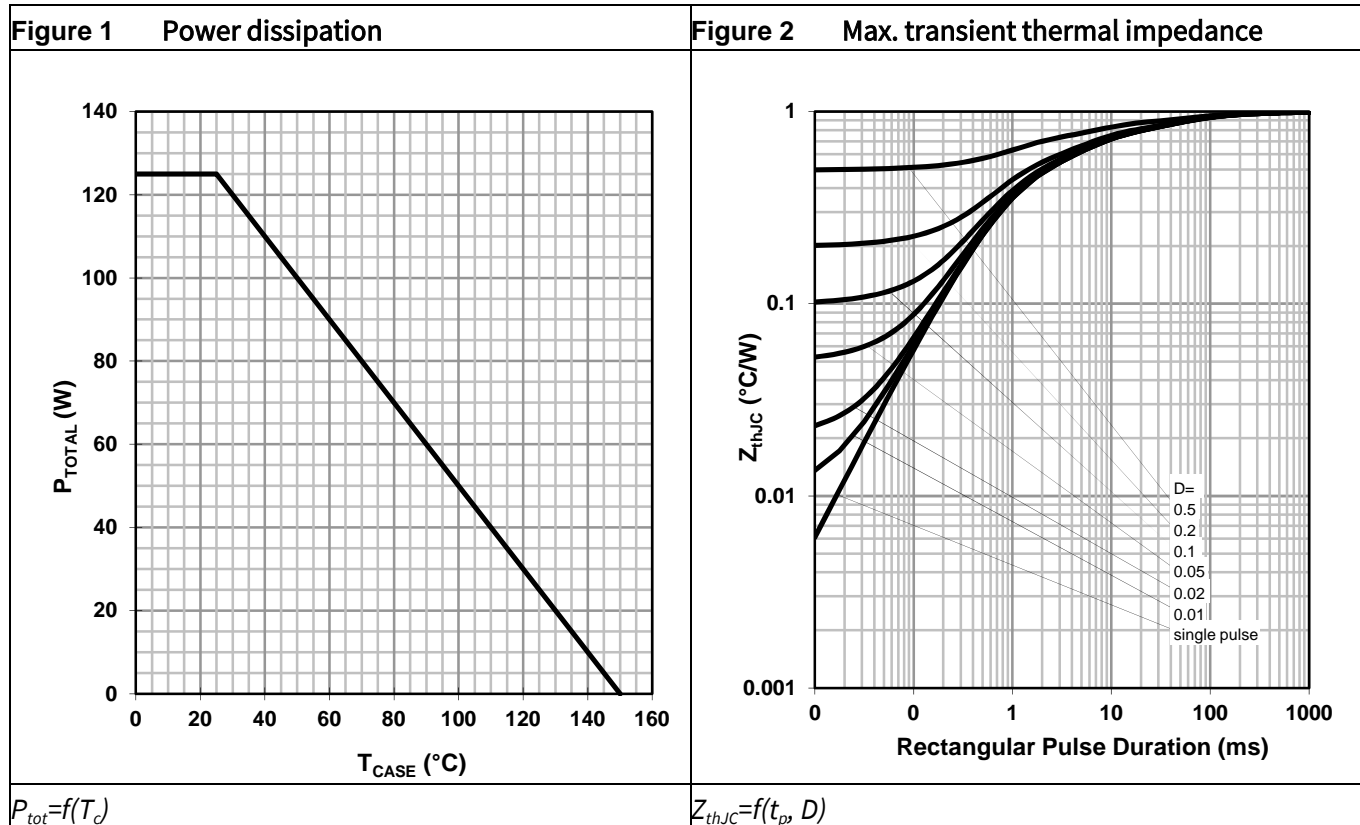
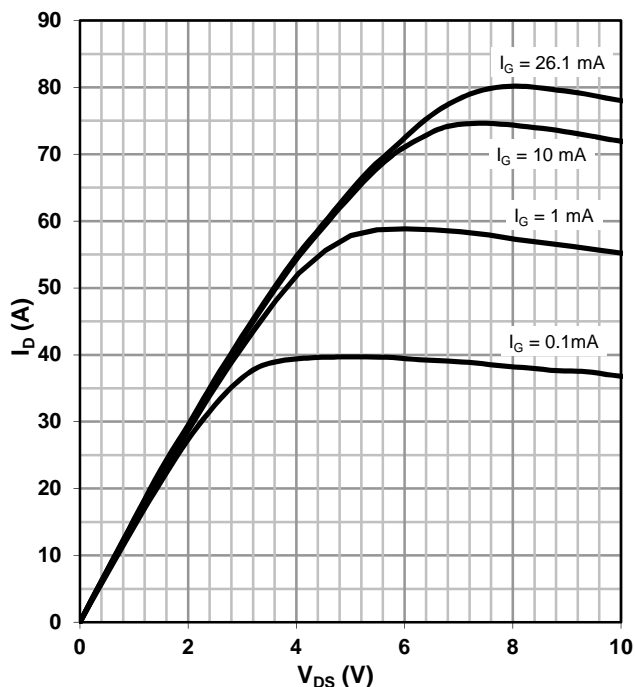
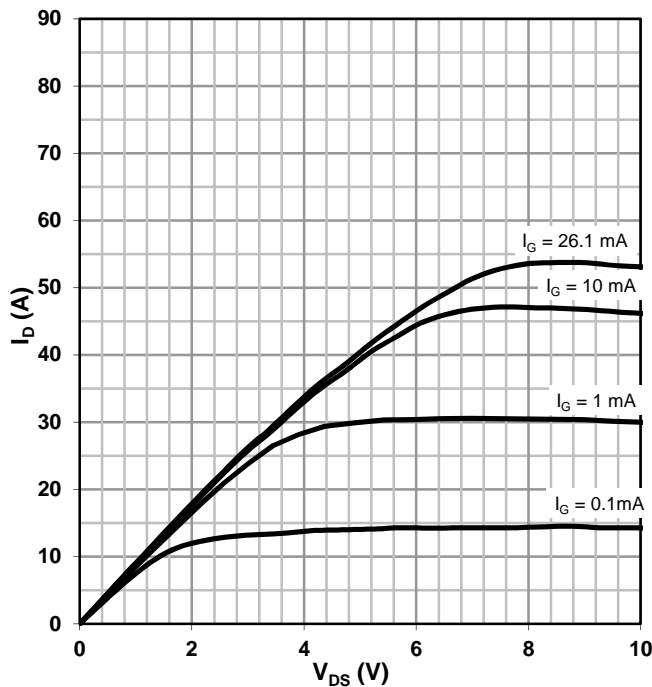


Figure 5 Typ. output characteristics



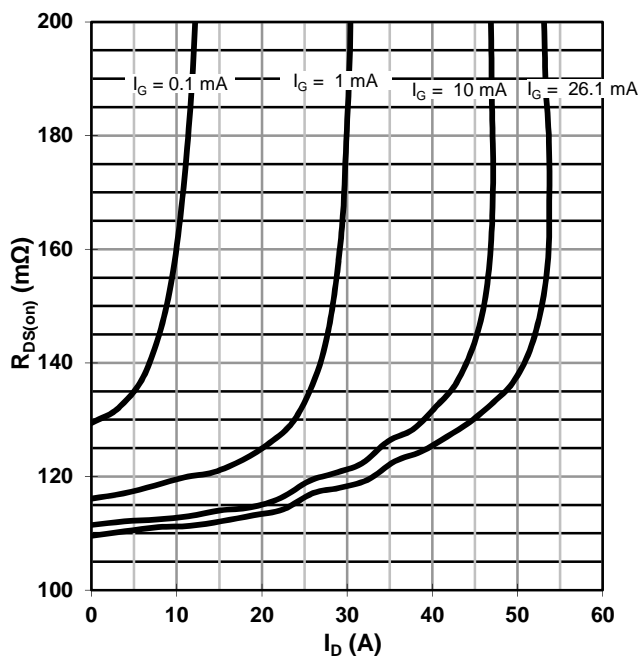
$I_D = f(V_{DS}, I_G); T_j = 25\text{ °C}$

Figure 6 Typ. output characteristics



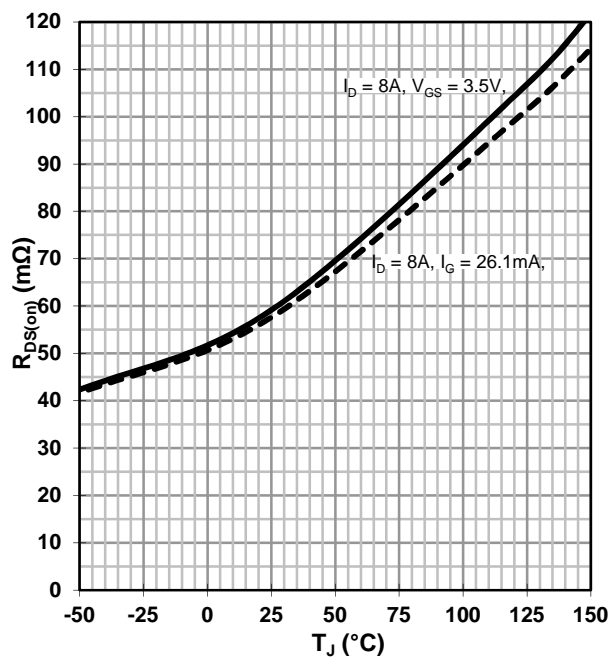
$I_D = f(V_{DS}, I_G); T_j = 125\text{ °C}$

Figure 7 Typ. Drain-source on-state resistance



$R_{dson} = f(I_D, I_G); T_j = 125\text{ °C}$

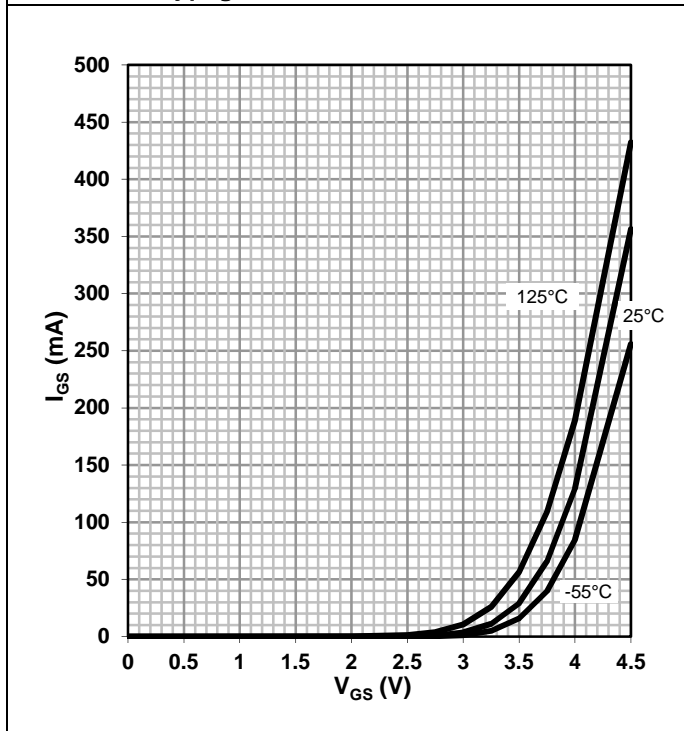
Figure 8 Drain-source on-state resistance



$R_{dson} = f(T_j); I_D = 8\text{ A}$

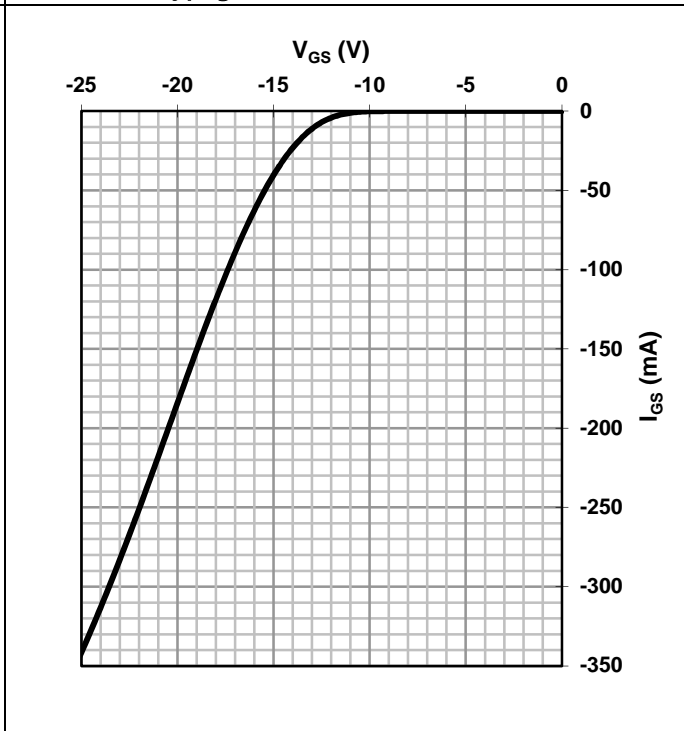


**Figure 9** Typ. gate characteristics forward



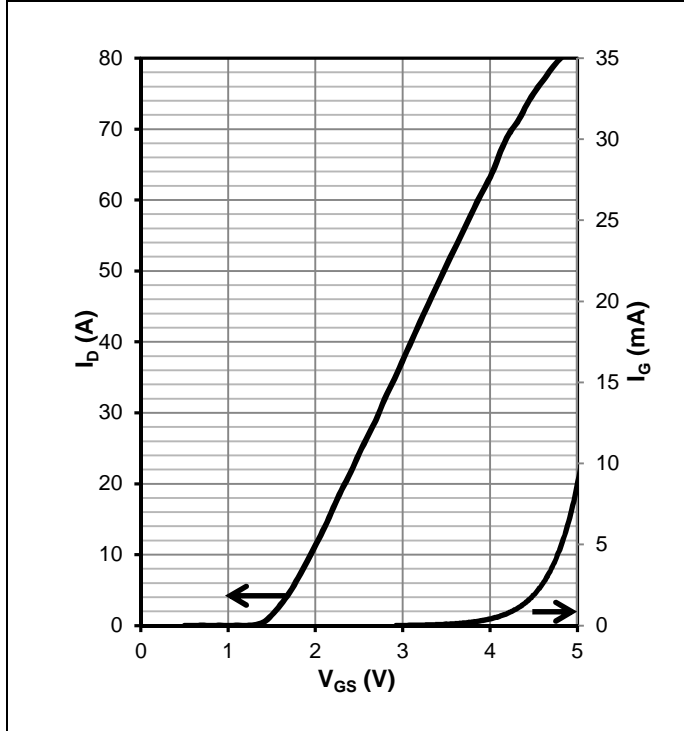
$I_{GS} = f(V_{GS}, T_j)$ ; open drain

**Figure 10** Typ. gate characteristics reverse



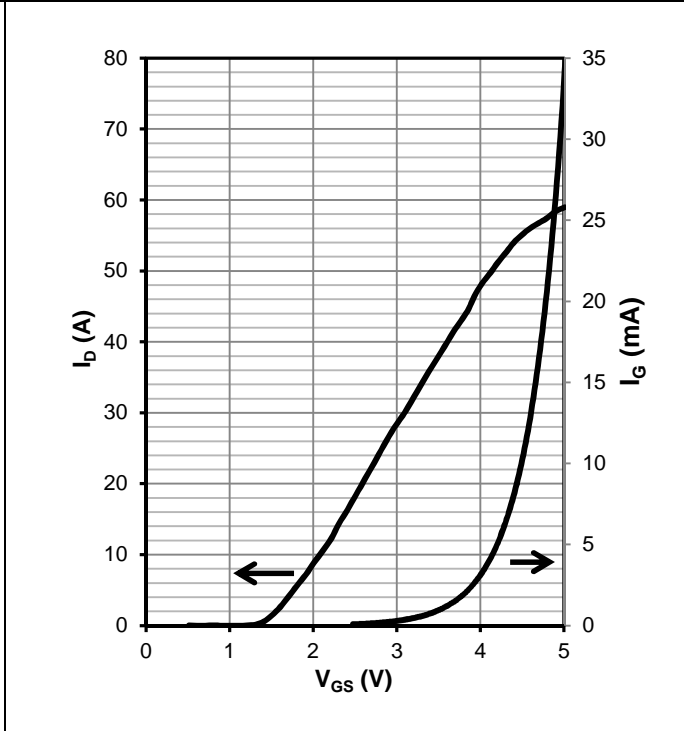
$I_{GS} = f(V_{GS})$ ;  $T_j = 25\text{ °C}$

**Figure 11** Typ. transfer characteristics



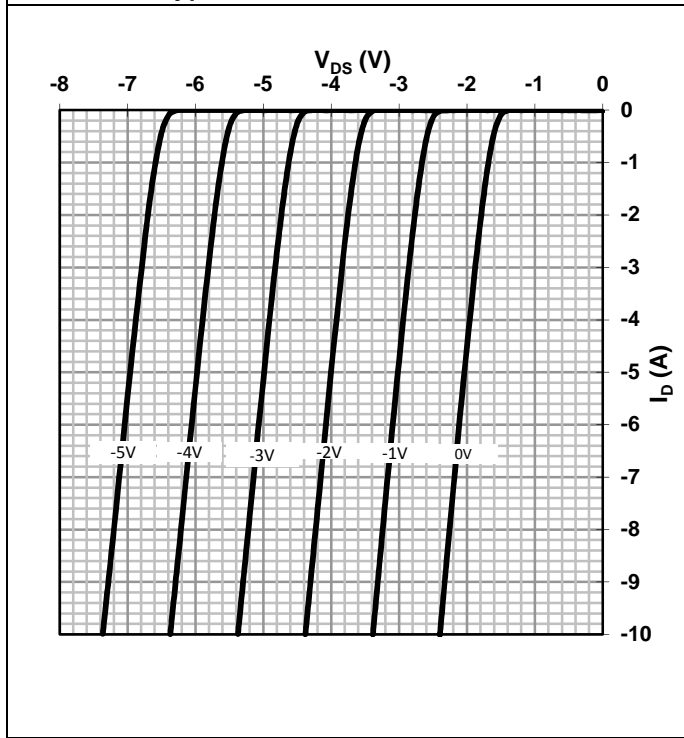
$I_D, I_G = f(V_{GS})$ ;  $V_{DS} = 8\text{ V}$ ;  $T_j = 25\text{ °C}$

**Figure 12** Typ. transfer characteristics



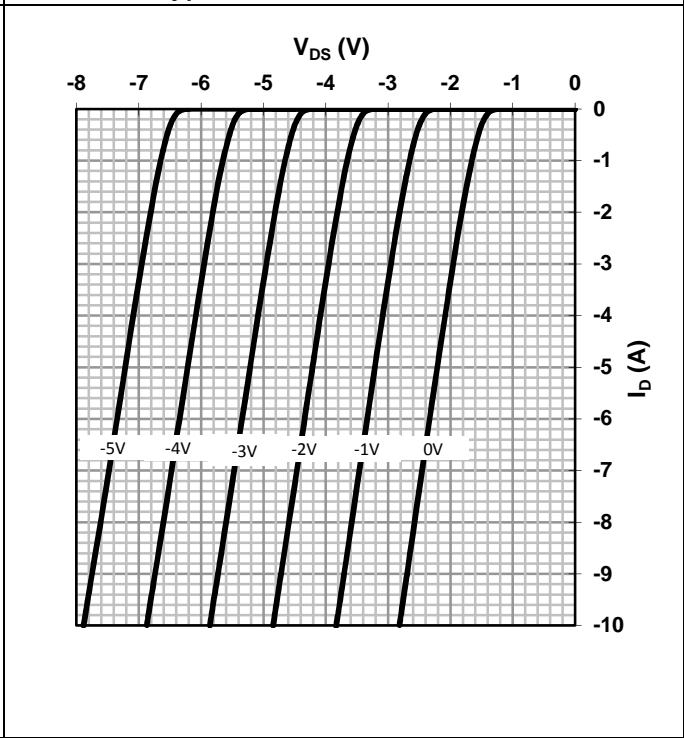
$I_D, I_G = f(V_{GS})$ ;  $V_{DS} = 8\text{ V}$ ;  $T_j = 125\text{ °C}$

Figure 13 Typ. channel reverse characteristics



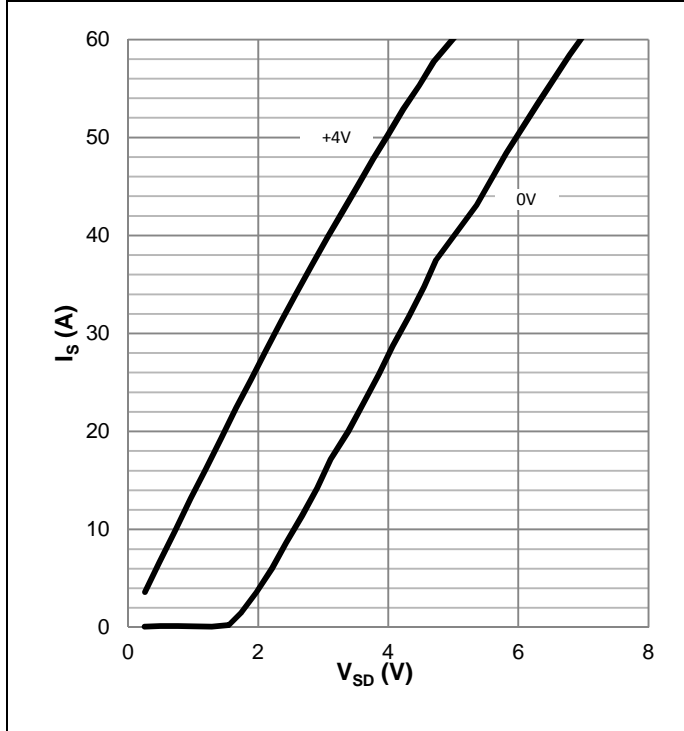
$V_{DS}=f(I_b, V_{GS}); T_j=25\text{ }^\circ\text{C}$

Figure 14 Typ. channel reverse characteristics



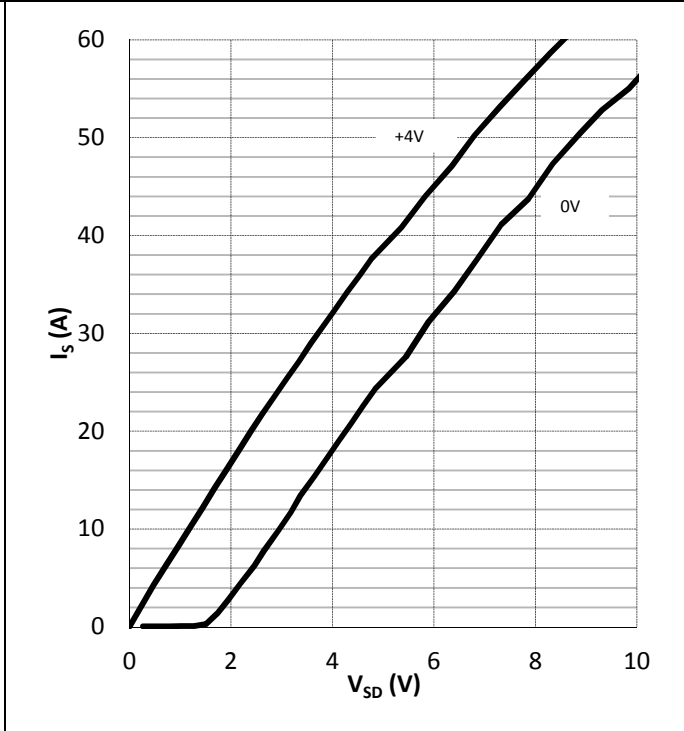
$V_{DS}=f(I_b, V_{GS}); T_j=125\text{ }^\circ\text{C}$

Figure 15 Typ. channel reverse characteristics



$I_D=f(V_{DS}, V_{GS}); T_j=25\text{ }^\circ\text{C}$

Figure 16 Typ. channel reverse characteristics



$I_D=f(V_{DS}, V_{GS}); T_j=125\text{ }^\circ\text{C}$

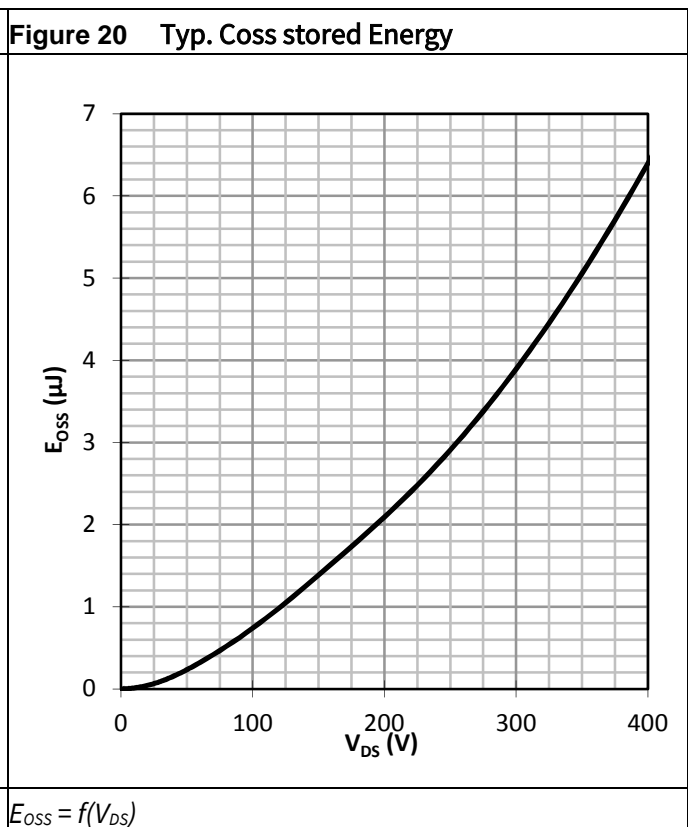
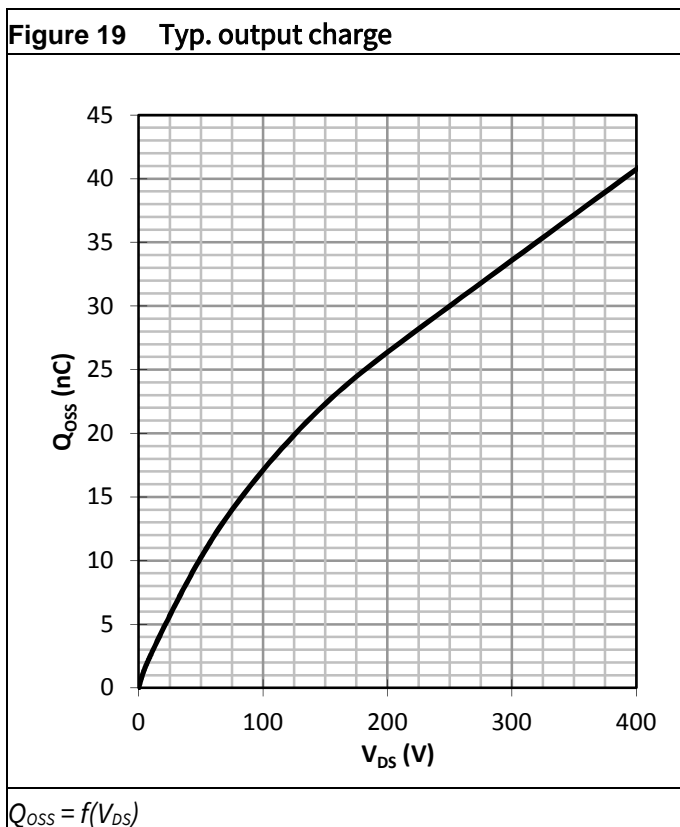
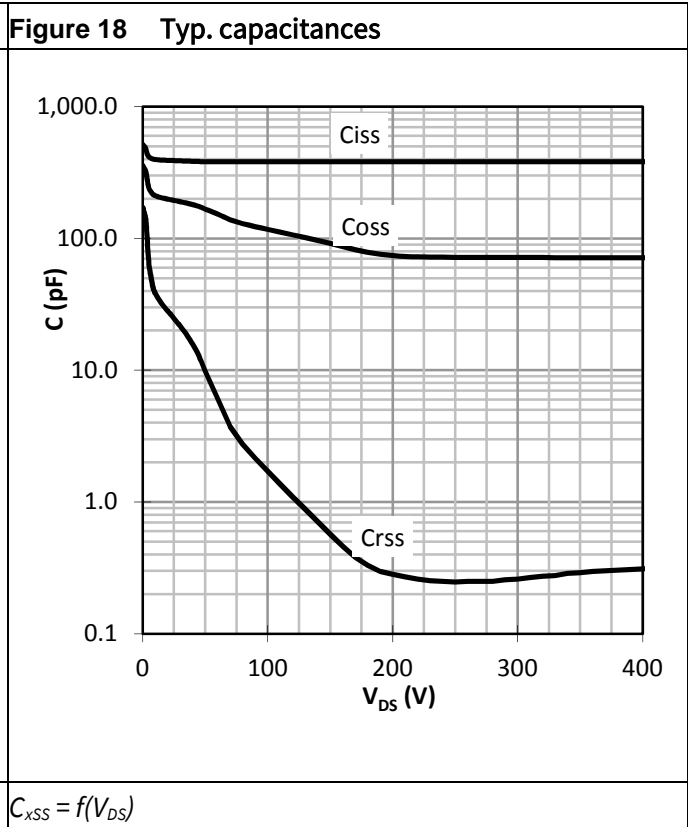
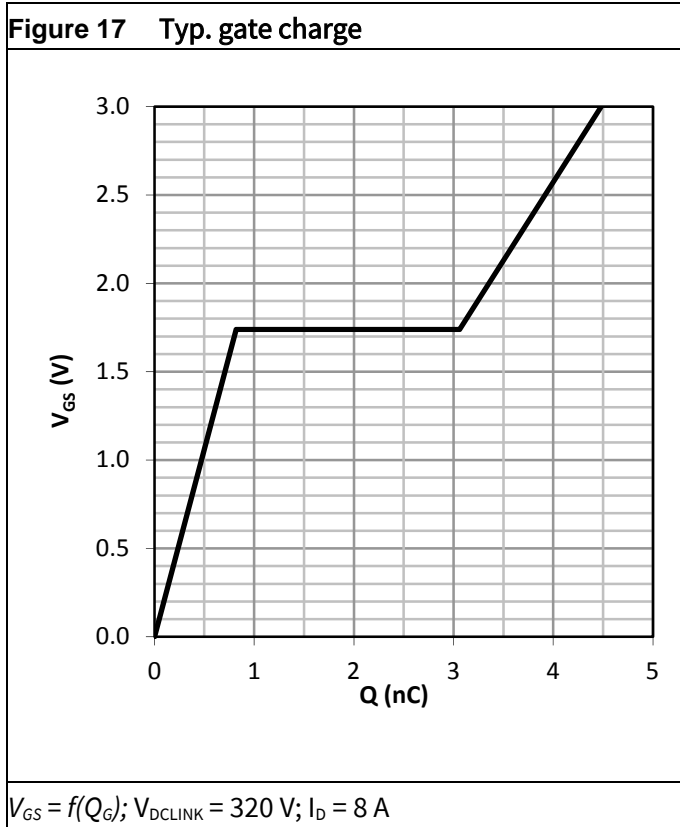
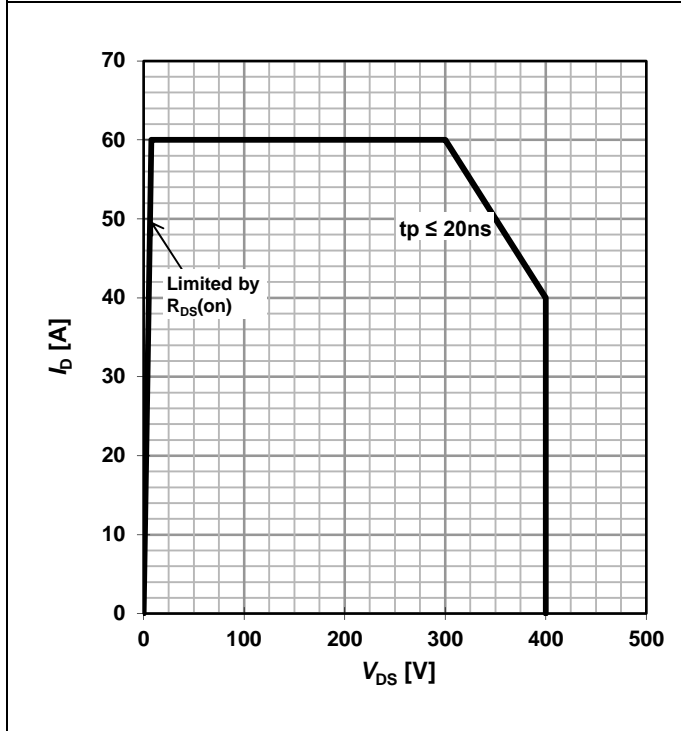
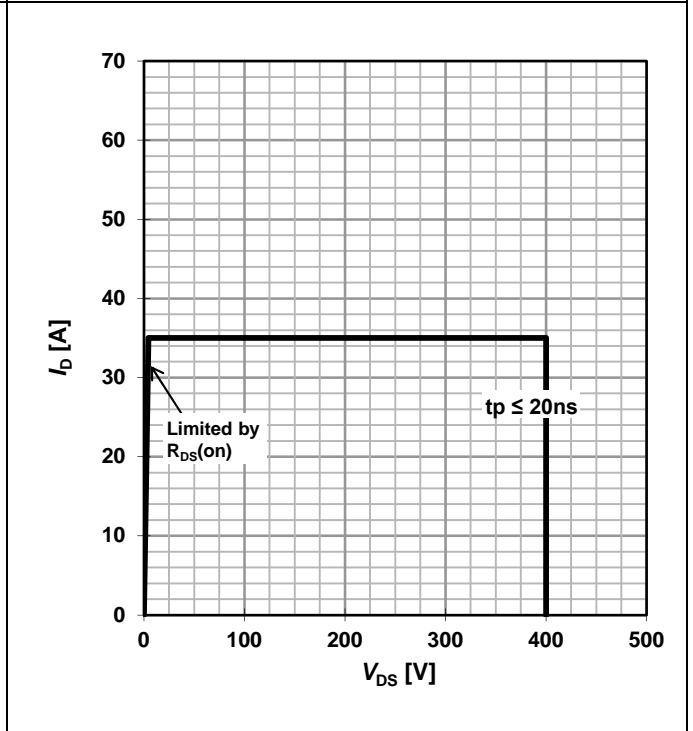


Figure 21 Repetitive safe operating area<sup>1</sup>



$T_c = 25\text{ °C}; T_j \leq 150\text{ °C}$

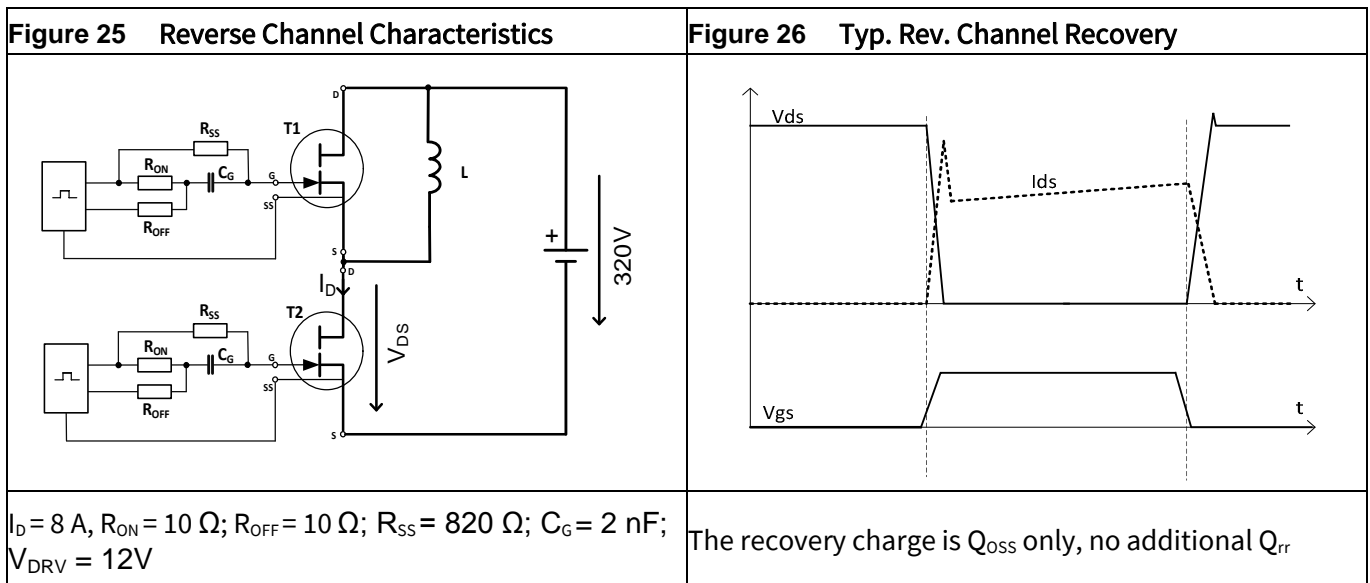
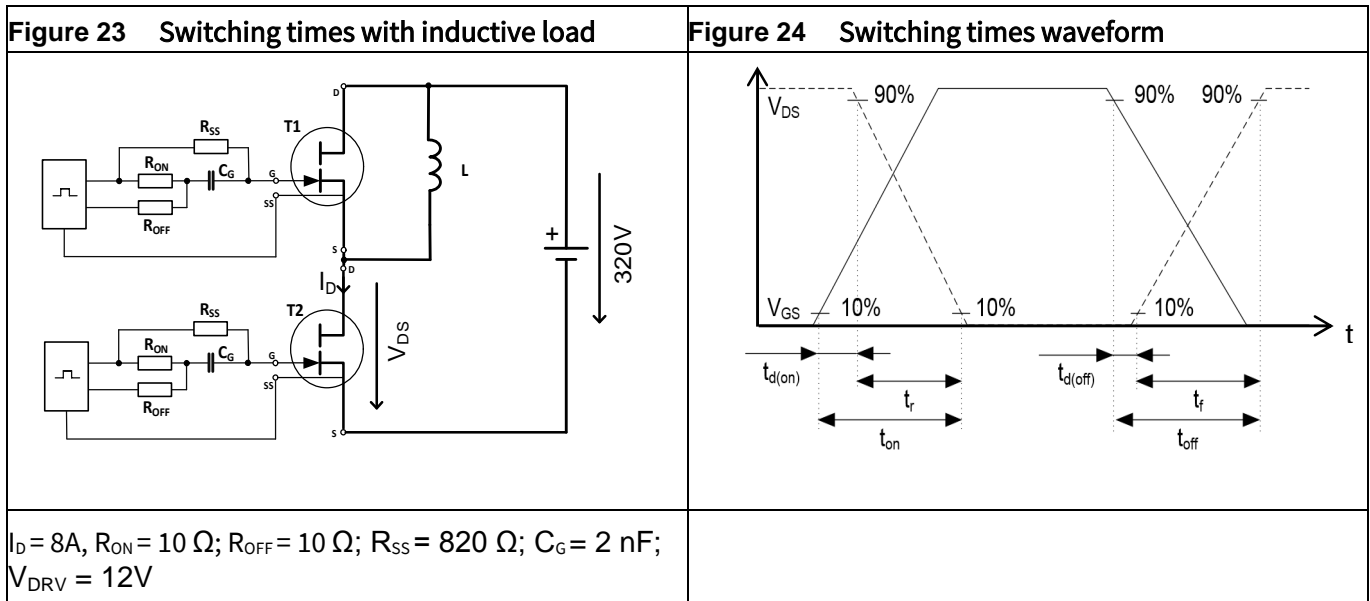
Figure 22 Repetitive safe operating area<sup>1</sup>



$T_c = 125\text{ °C}; T_j \leq 150\text{ °C}$

<sup>1</sup> Parameter is influenced by rel-requirements. Please contact the local Infineon Sales Office to get an assessment of your application.

## 5 Test Circuits



## 6 Package Outlines

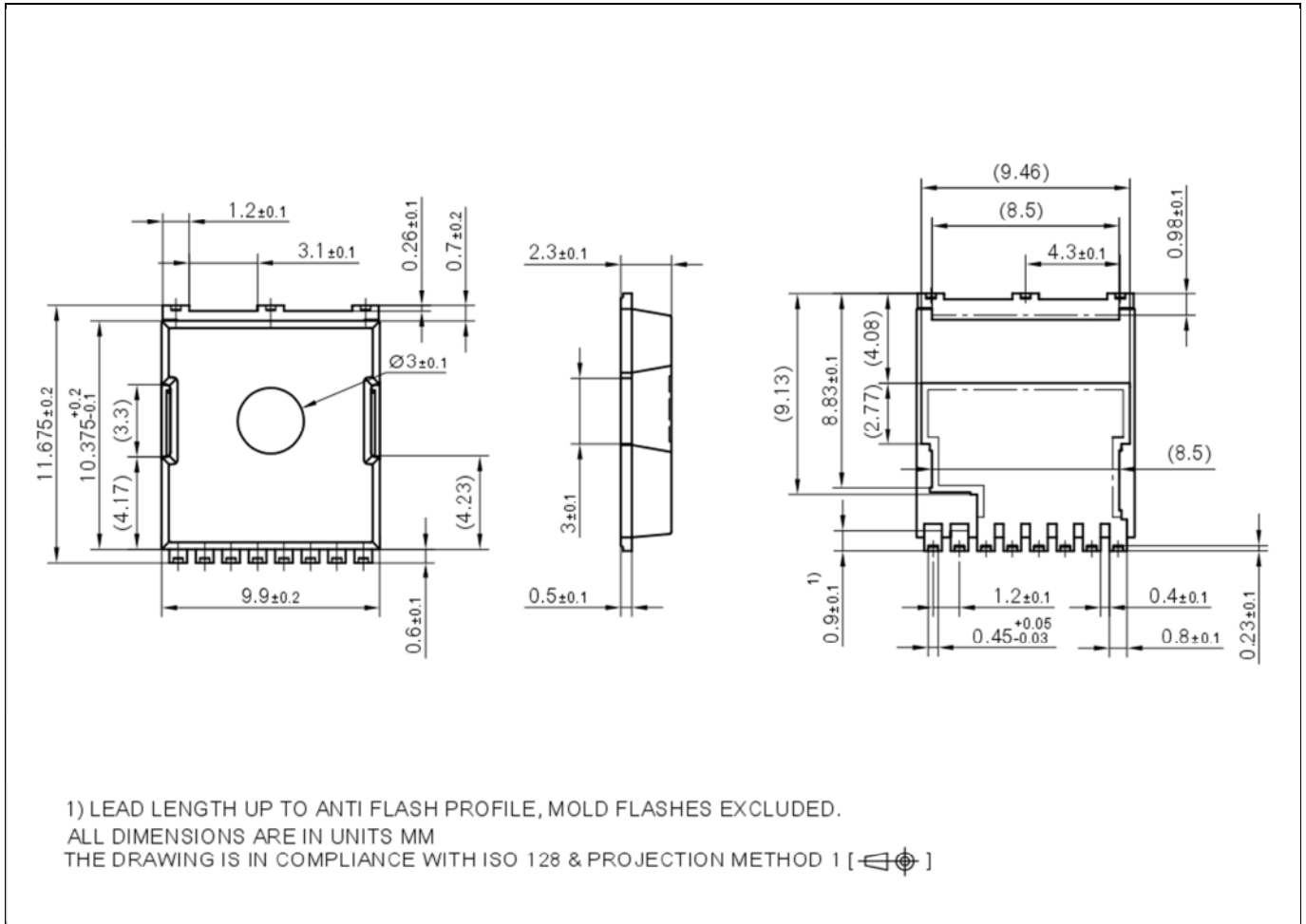


Figure 27 PG-HSOF-8 Package Outline, dimensions (mm)

## 7 Revision History

### Major changes since the last revision

Revision	Date	Description of change
2.0	2018-04-25	Release of final version

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**Edition 2018-04-25**

**Published by**

**Infineon Technologies AG**

**81726 München, Germany**

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