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1 Maximum ratings

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

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current ¹⁾	I_D	-	-	31 20	A	$T_C=25^\circ\text{C}$ $T_C=100^\circ\text{C}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	100	A	$T_C=25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}	-	-	105	mJ	$I_D=5.1\text{A}$; $V_{DD}=50\text{V}$; see table 10
Avalanche energy, repetitive	E_{AR}	-	-	0.53	mJ	$I_D=5.1\text{A}$; $V_{DD}=50\text{V}$; see table 10
Avalanche current, single pulse	I_{AS}	-	-	5.1	A	-
MOSFET dv/dt ruggedness	dv/dt	-	-	80	V/ns	$V_{DS}=0\dots400\text{V}$
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Gate source voltage (dynamic)	V_{GS}	-30	-	30	V	AC ($f>1\text{ Hz}$)
Power dissipation	P_{tot}	-	-	117	W	$T_C=25^\circ\text{C}$
Storage temperature	T_{stg}	-55	-	150	$^\circ\text{C}$	-
Operating junction temperature	T_j	-55	-	150	$^\circ\text{C}$	-
Mounting torque	-	-	-	60	Ncm	M3 and M3.5 screws
Continuous diode forward current	I_S	-	-	31	A	$T_C=25^\circ\text{C}$
Diode pulse current ²⁾	$I_{S,pulse}$	-	-	100	A	$T_C=25^\circ\text{C}$
Reverse diode dv/dt ³⁾	dv/dt	-	-	50	V/ns	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq 31\text{A}$, $T_j=25^\circ\text{C}$ see table 8
Maximum diode commutation speed	di/dt	-	-	900	A/ μs	$V_{DS}=0\dots400\text{V}$, $I_{SD}\leq 31\text{A}$, $T_j=25^\circ\text{C}$ see table 8
Insulation withstand voltage	V_{ISO}	-	-	n.a.	V	V_{rms} , $T_C=25^\circ\text{C}$, $t=1\text{min}$

¹⁾ Limited by $T_{j,max}$. Maximum Duty Cycle $D = 0.50$

²⁾ Pulse width t_p limited by $T_{j,max}$

³⁾ Identical low side and high side switch with identical R_θ

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	-	-	1.07	°C/W	-
Thermal resistance, junction - ambient	R_{thJA}	-	-	62	°C/W	leaded
Thermal resistance, junction - ambient for SMD version	R_{thJA}	-	-	-	°C/W	-
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	-	-	260	°C	1.6mm (0.063 in.) from case for 10s

3 Electrical characteristics

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

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	600	-	-	V	$V_{GS}=0V$, $I_D=1mA$
Gate threshold voltage	$V_{(GS)th}$	3	3.5	4	V	$V_{DS}=V_{GS}$, $I_D=0.53mA$
Zero gate voltage drain current	I_{DSS}	-	-	1	μA	$V_{DS}=600V$, $V_{GS}=0V$, $T_j=25^\circ\text{C}$ $V_{DS}=600V$, $V_{GS}=0V$, $T_j=150^\circ\text{C}$
Gate-source leakage current	I_{GSS}	-	-	100	nA	$V_{GS}=20V$, $V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	0.077 0.180	0.099 -	Ω	$V_{GS}=10V$, $I_D=10.5A$, $T_j=25^\circ\text{C}$ $V_{GS}=10V$, $I_D=10.5A$, $T_j=150^\circ\text{C}$
Gate resistance	R_G	-	5.9	-	Ω	$f=1MHz$, open drain

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	1952	-	pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=250kHz$
Output capacitance	C_{oss}	-	33	-	pF	$V_{GS}=0V$, $V_{DS}=400V$, $f=250kHz$
Effective output capacitance, energy related ¹⁾	$C_{o(er)}$	-	62	-	pF	$V_{GS}=0V$, $V_{DS}=0...400V$
Effective output capacitance, time related ²⁾	$C_{o(tr)}$	-	648	-	pF	$I_D=\text{constant}$, $V_{GS}=0V$, $V_{DS}=0...400V$
Turn-on delay time	$t_{d(on)}$	-	23	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=10.5A$, $R_G=5.3\Omega$; see table 9
Rise time	t_r	-	15	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=10.5A$, $R_G=5.3\Omega$; see table 9
Turn-off delay time	$t_{d(off)}$	-	89	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=10.5A$, $R_G=5.3\Omega$; see table 9
Fall time	t_f	-	5	-	ns	$V_{DD}=400V$, $V_{GS}=13V$, $I_D=10.5A$, $R_G=5.3\Omega$; see table 9

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	10	-	nC	$V_{DD}=400V$, $I_D=10.5A$, $V_{GS}=0$ to $10V$
Gate to drain charge	Q_{gd}	-	14	-	nC	$V_{DD}=400V$, $I_D=10.5A$, $V_{GS}=0$ to $10V$
Gate charge total	Q_g	-	45	-	nC	$V_{DD}=400V$, $I_D=10.5A$, $V_{GS}=0$ to $10V$
Gate plateau voltage	$V_{plateau}$	-	5.2	-	V	$V_{DD}=400V$, $I_D=10.5A$, $V_{GS}=0$ to $10V$

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

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

Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.9	-	V	$V_{GS}=0V$, $I_F=10.5A$, $T_J=25^{\circ}C$
Reverse recovery time	t_{rr}	-	211	-	ns	$V_R=400V$, $I_F=4A$, $di_F/dt=100A/\mu s$; see table 8
Reverse recovery charge	Q_{rr}	-	2.1	-	μC	$V_R=400V$, $I_F=4A$, $di_F/dt=100A/\mu s$; see table 8
Peak reverse recovery current	I_{rrm}	-	20.1	-	A	$V_R=400V$, $I_F=4A$, $di_F/dt=100A/\mu s$; see table 8

4 Electrical characteristics diagrams

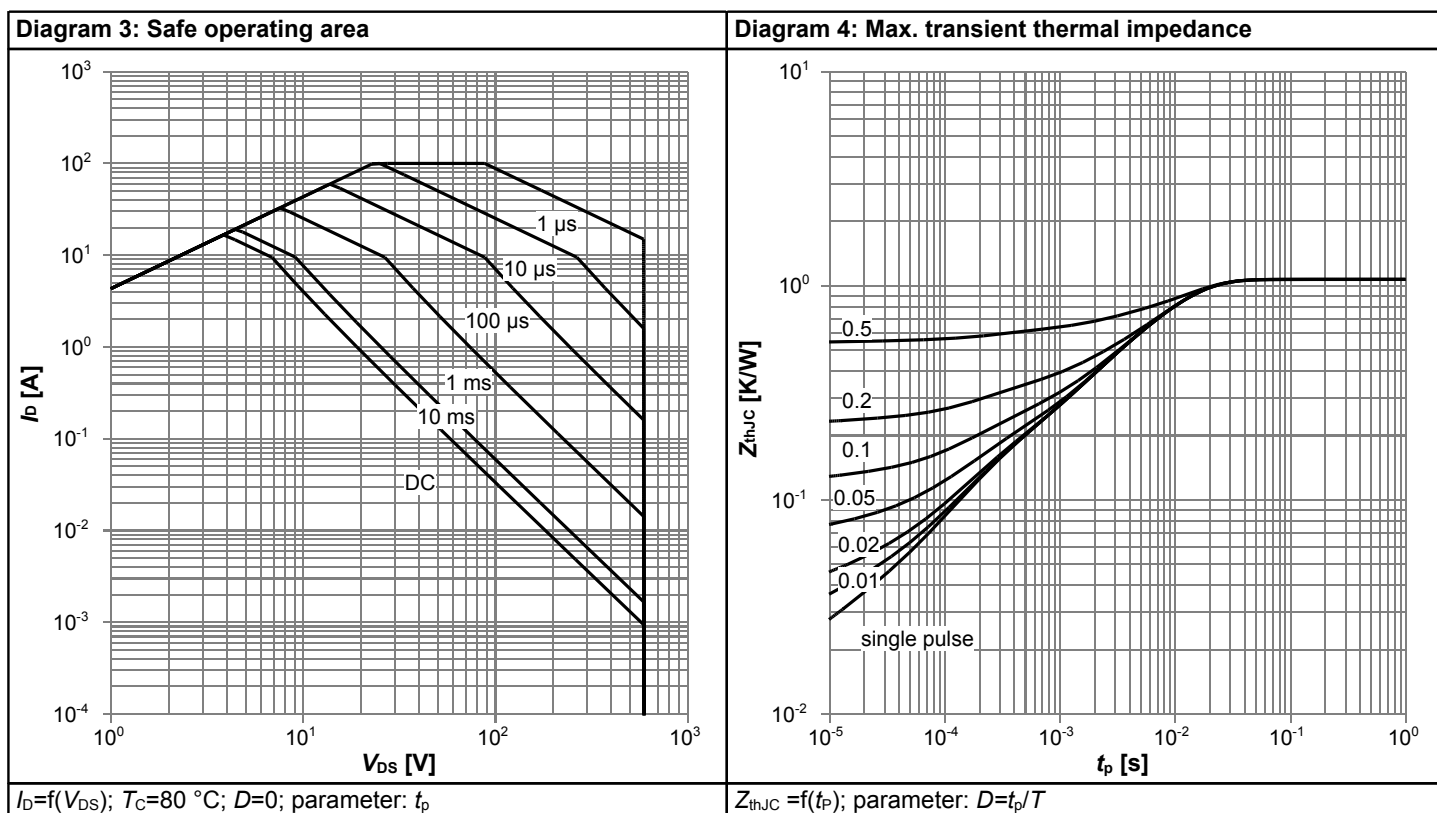
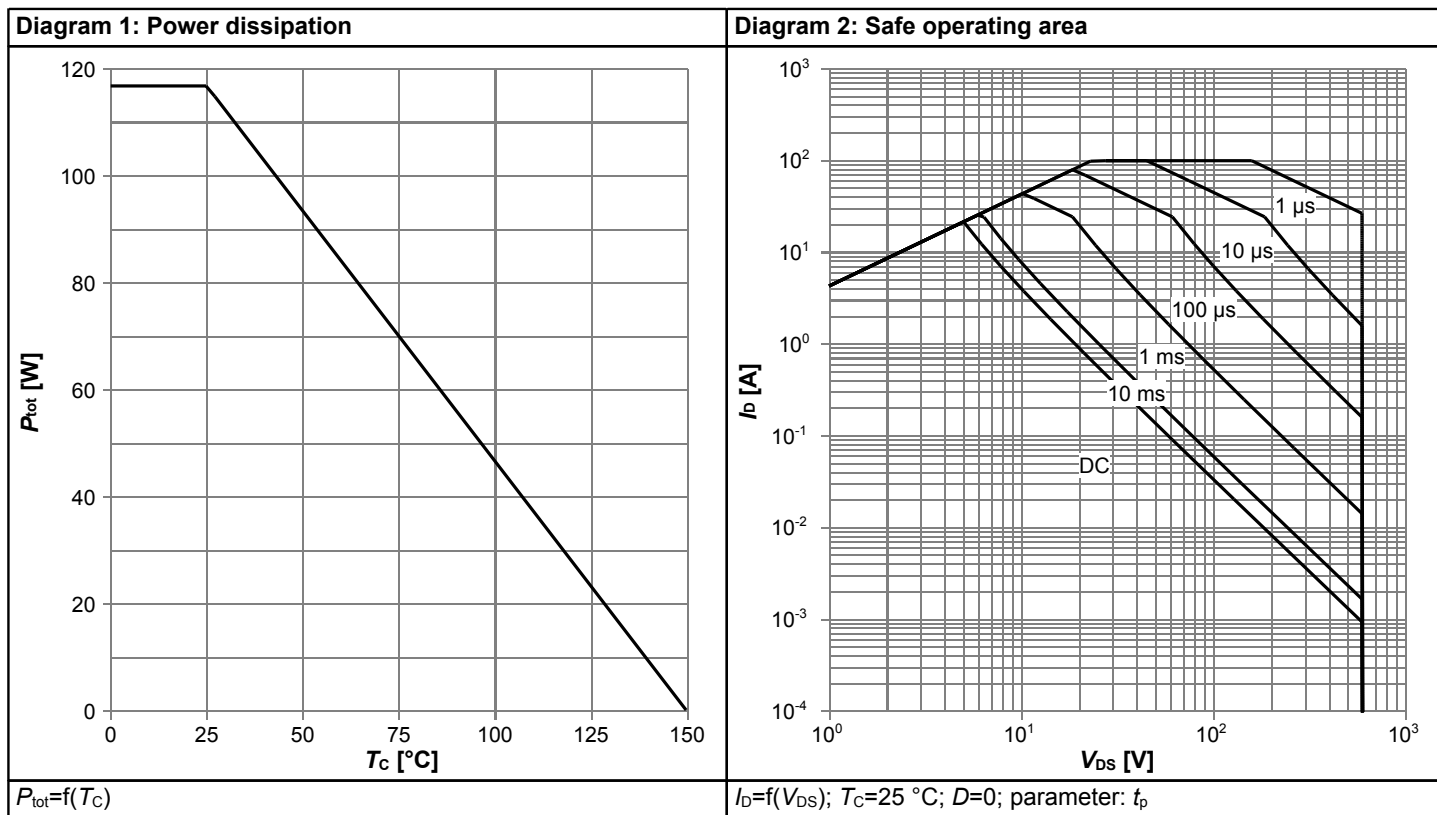
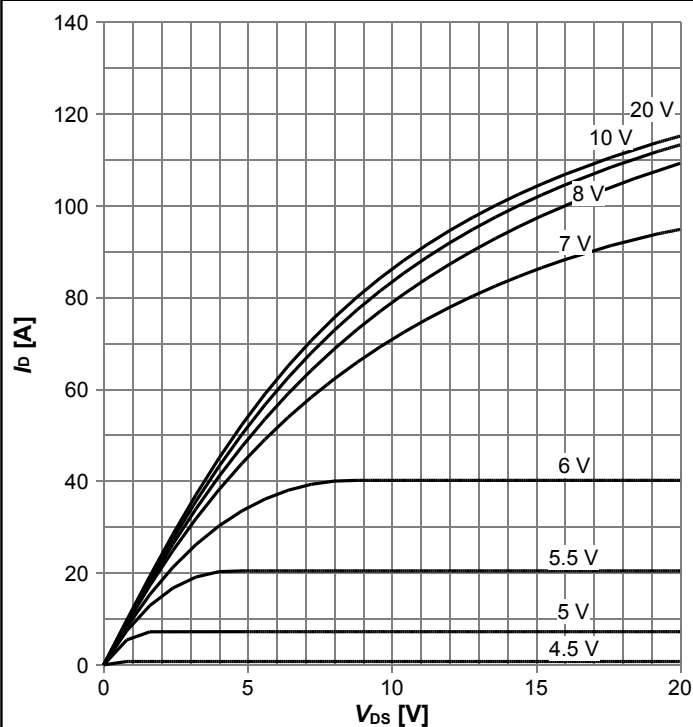
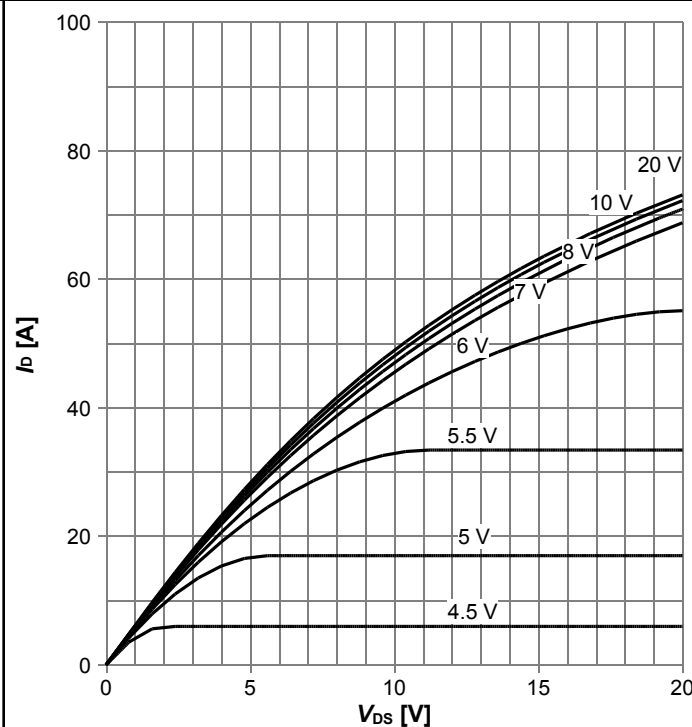


Diagram 5: Typ. output characteristics



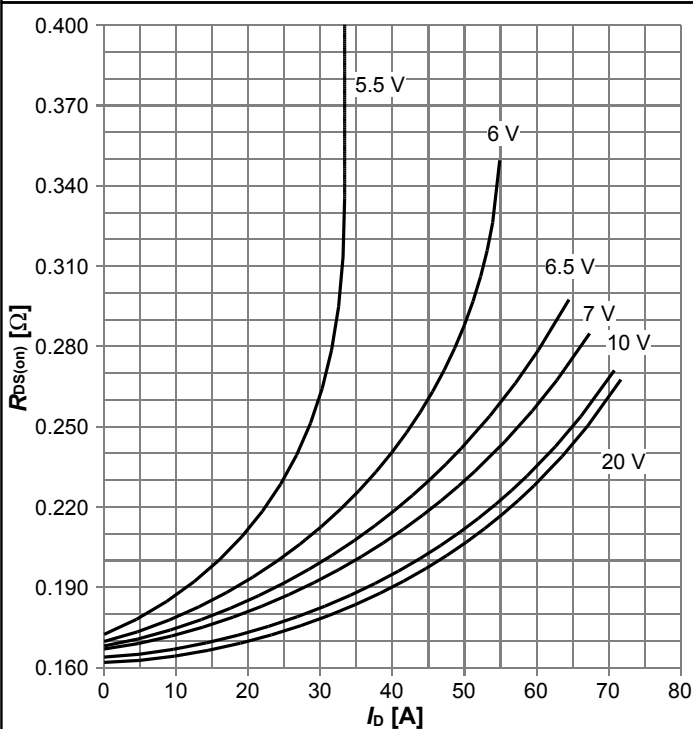
$I_D = f(V_{DS})$; $T_j = 25\text{ °C}$; parameter: V_{GS}

Diagram 6: Typ. output characteristics



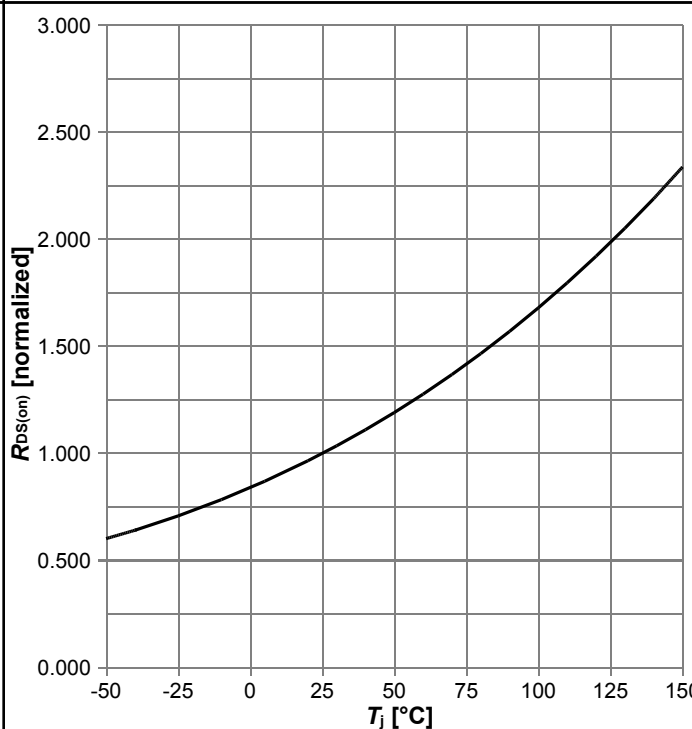
$I_D = f(V_{DS})$; $T_j = 125\text{ °C}$; parameter: V_{GS}

Diagram 7: Typ. drain-source on-state resistance



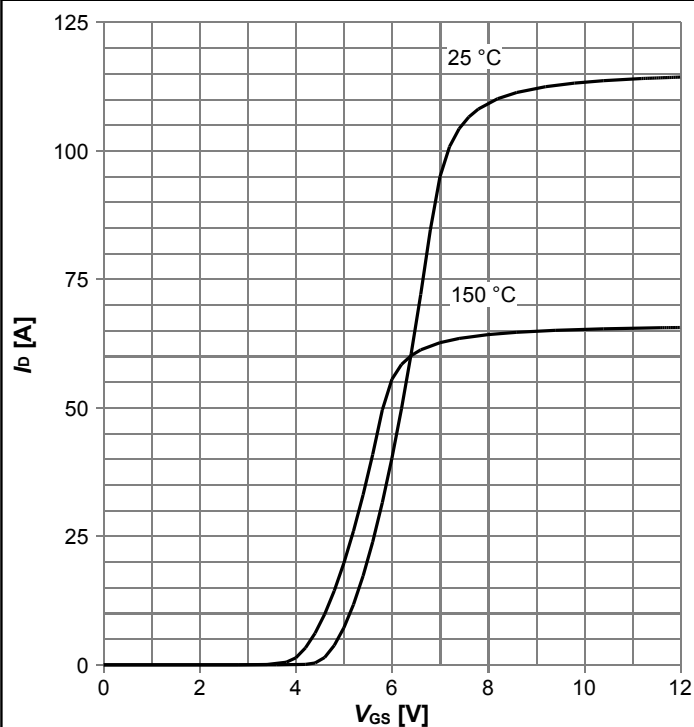
$R_{DS(on)} = f(I_D)$; $T_j = 125\text{ °C}$; parameter: V_{GS}

Diagram 8: Drain-source on-state resistance



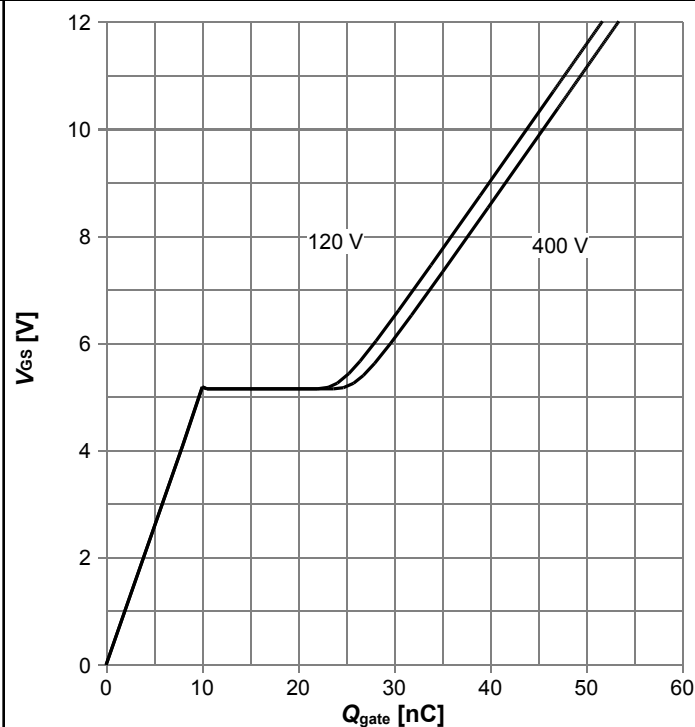
$R_{DS(on)} = f(T_j)$; $I_D = 10.5\text{ A}$; $V_{GS} = 10\text{ V}$

Diagram 9: Typ. transfer characteristics



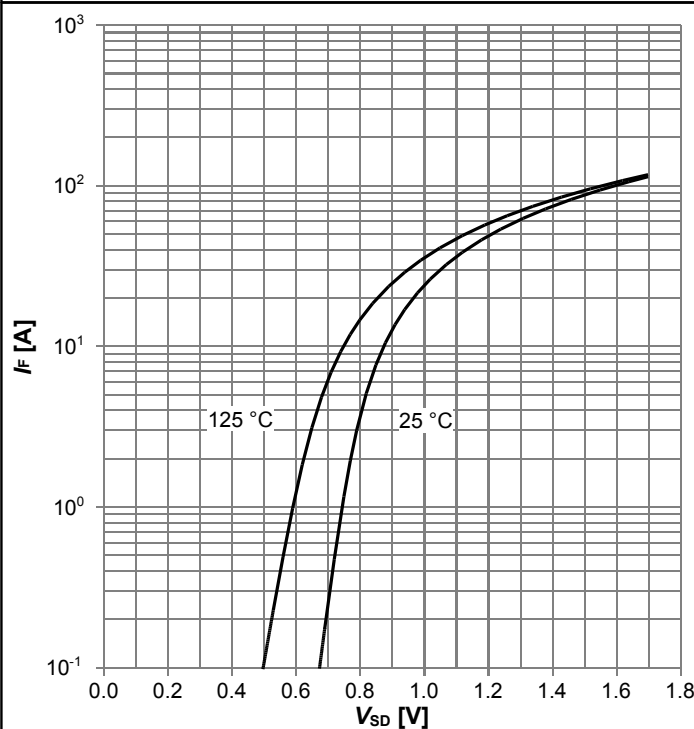
$I_D = f(V_{GS})$; $V_{DS} = 20\text{ V}$; parameter: T_j

Diagram 10: Typ. gate charge



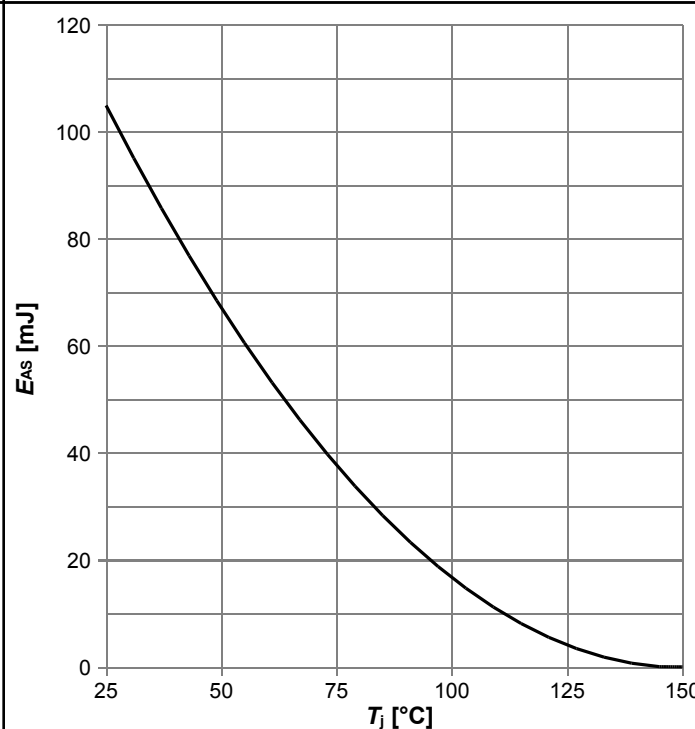
$V_{GS} = f(Q_{gate})$; $I_D = 10.5\text{ A}$ pulsed; parameter: V_{DD}

Diagram 11: Forward characteristics of reverse diode



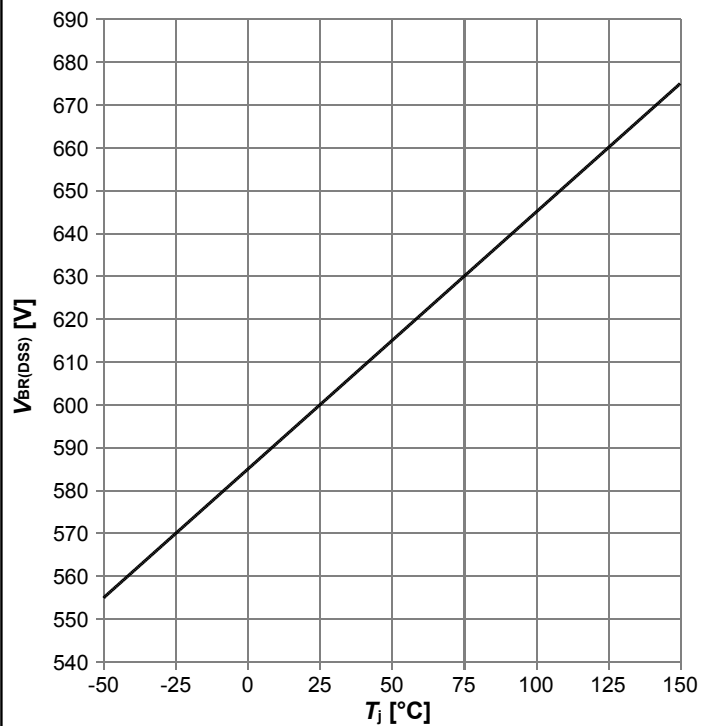
$I_F = f(V_{SD})$; parameter: T_j

Diagram 12: Avalanche energy



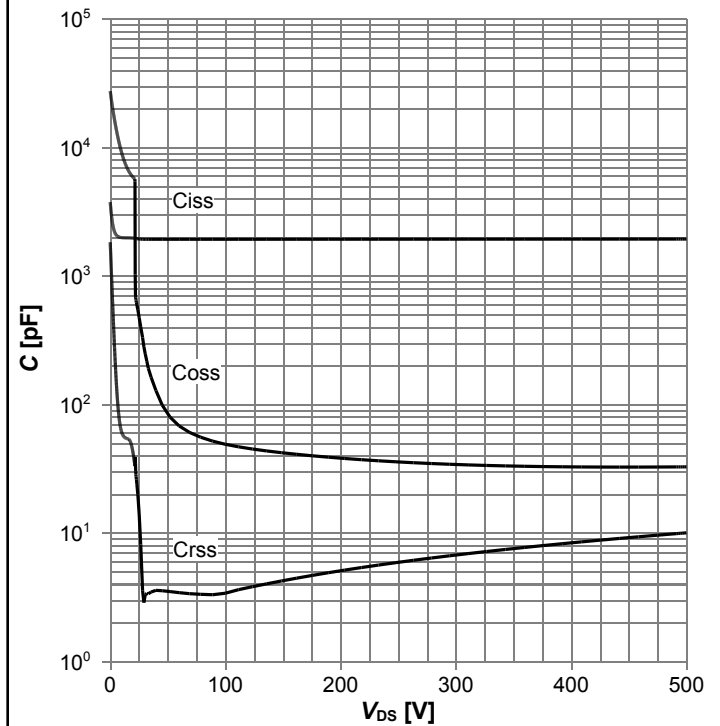
$E_{AS} = f(T_j)$; $I_D = 5.1\text{ A}$; $V_{DD} = 50\text{ V}$

Diagram 13: Drain-source breakdown voltage



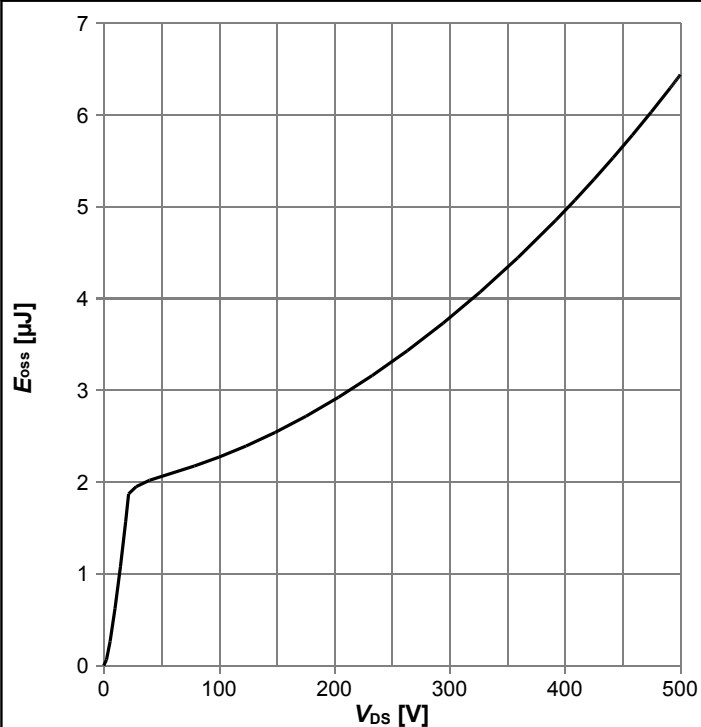
$V_{BR(DSS)} = f(T_J); I_D = 1 \text{ mA}$

Diagram 14: Typ. capacitances



$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 250 \text{ kHz}$

Diagram 15: Typ. Coss stored energy



$E_{oss} = f(V_{DS})$

5 Test Circuits

Table 8 Diode characteristics

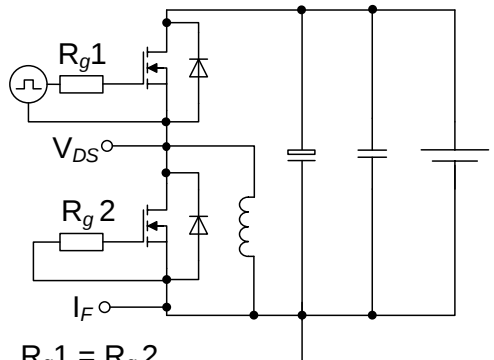
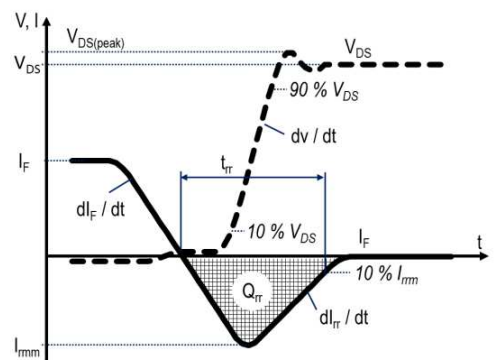
Test circuit for diode characteristics	Diode recovery waveform
 $R_{g1} = R_{g2}$	

Table 9 Switching times

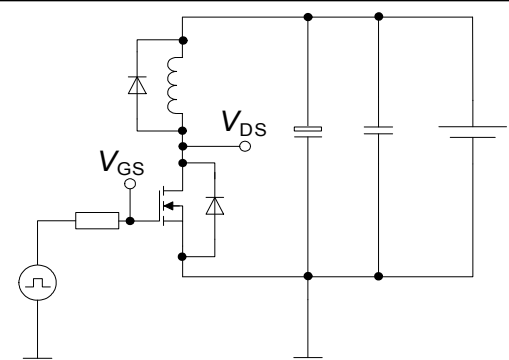
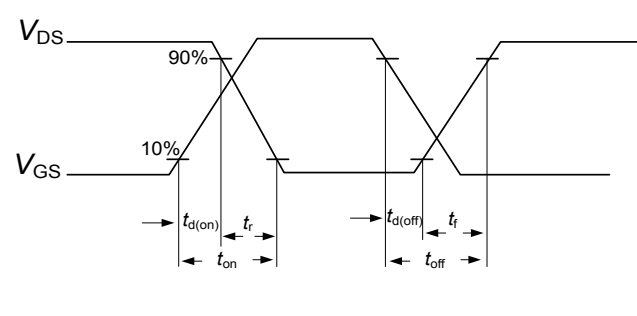
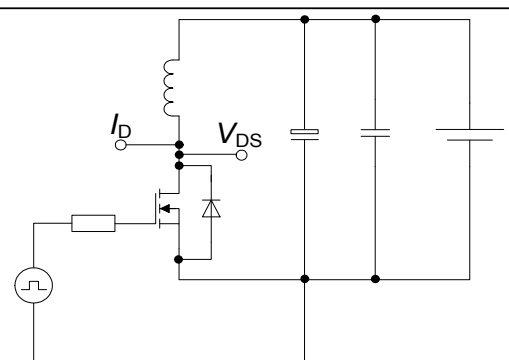
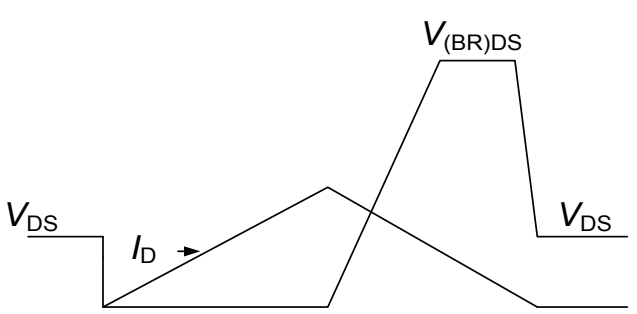
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

6 Package Outlines

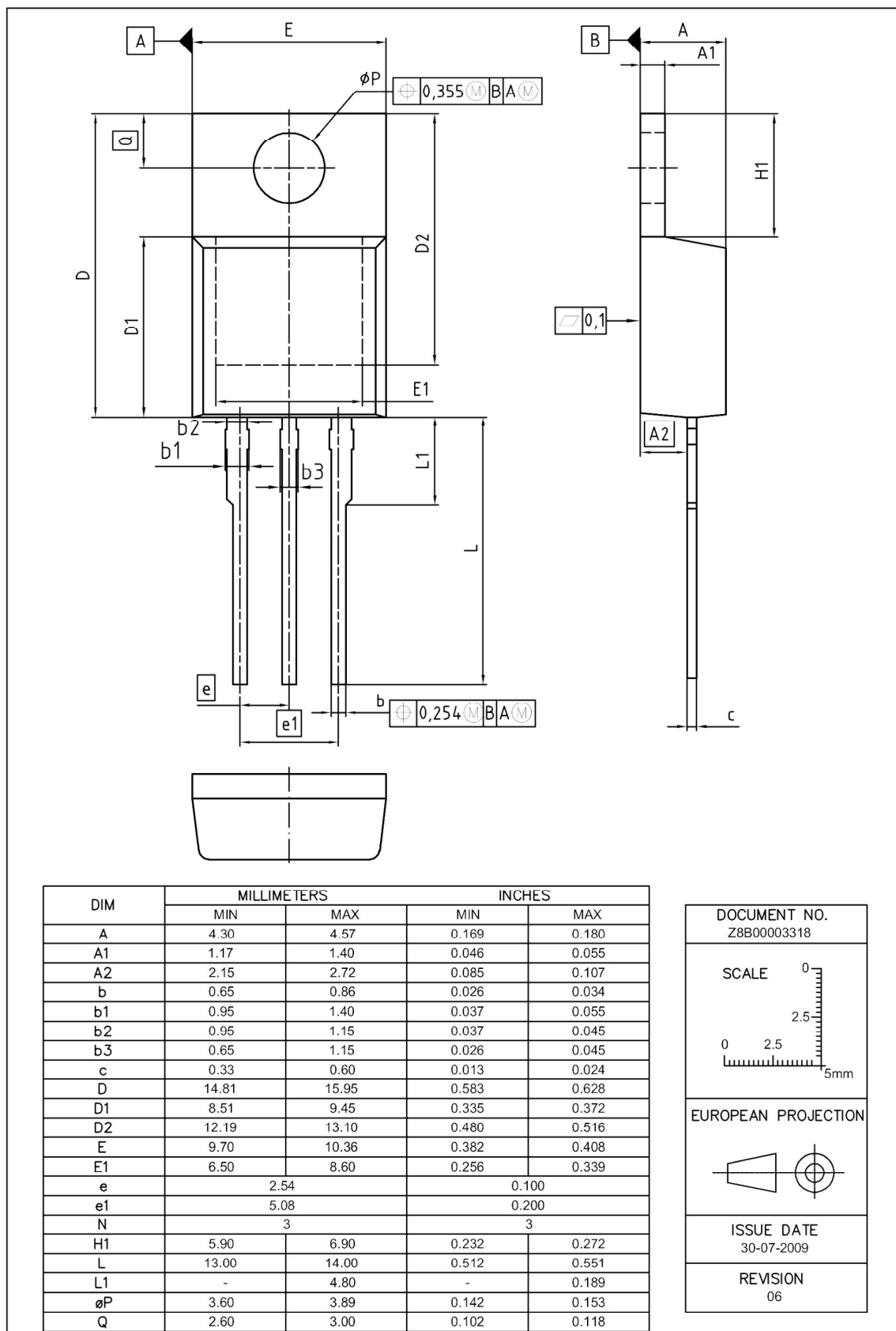


Figure 1 Outline PG-TO 220-3, dimensions in mm/inches

7 Appendix A

Table 11 Related Links

- IFX CoolMOS P7 Webpage: www.infineon.com
- IFX CoolMOS P7 application note: www.infineon.com
- IFX CoolMOS P7 simulation model: www.infineon.com
- IFX Design tools: www.infineon.com

Revision History

IPP60R099P7

Revision: 2018-05-15, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2017-05-18	Release of final version
2.1	2018-05-15	Updated diagram scalings; Nomenclature of product qualification grade was changed

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