

Final datasheet

CoolSiC™ 1400 V SiC MOSFET G2 : Silicon Carbide MOSFET with .XT interconnection technology

Features

- $V_{DS} = 1400 \text{ V}$ at $T_{vj} = 25^\circ\text{C}$
- $I_{DC} = 58 \text{ A}$ at $T_C = 100^\circ\text{C}$
- $R_{DS(on)} = 24 \text{ m}\Omega$ at $V_{GS} = 18 \text{ V}$, $T_{vj} = 25^\circ\text{C}$
- Very low switching losses
- Package backside suitable for reflow soldering at 260°C , 3 times
- Overload operation up to $T_{vj} = 200^\circ\text{C}$
- Short circuit withstand time $2 \mu\text{s}$
- Benchmark gate threshold voltage, $V_{GS(th)} = 4.2 \text{ V}$
- Robust against parasitic turn on, 0 V turn-off gate voltage can be applied
- Robust body diode for hard commutation
- .XT interconnection technology for best-in-class thermal performance
- Wide power pins (2 mm) for high current capability
- Resistive weldable pins for direct busbar connections
- TO247PLUS package with high creepage distance 10.8 mm and $CTI \geq 600 \text{ V}$
- Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>



Potential applications

- Commercial, construction and agricultural vehicles (CAV)
- EV Charging
- Online UPS / Industrial UPS
- String inverter
- Energy storage systems (ESS)
- General purpose drives (GPD)

Product validation

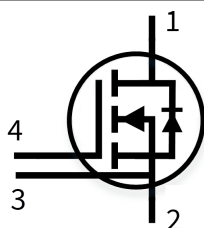
- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Description

Pin definition:

- 1 – Drain
- 2 – Source
- 3 – Kelvin sense contact
- 4 – Gate

Note: the source and sense pins are not exchangeable, their exchange might lead to malfunction



Type	Package	Marking
IMYR140R024M2H	PG-TO247-4-U08	14M2H024



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1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
		reflow soldering (MSL2 according to JEDEC J-STD-020)			260	
Thermal resistance, junction-ambient	$R_{th(j-a)}$				62	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			0.35	0.46	K/W
Comparative Tracking Index	CTI		600			V

2 MOSFET

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} \geq 25\text{ °C}$		1400	V
Continuous DC drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$	I_{DDC}	$V_{GS} = 18\text{ V}$	$T_c = 25\text{ °C}$	82	A
			$T_c = 100\text{ °C}$	58	
Peak drain current, t_p limited by $T_{vj(max)}$ ¹⁾	I_{DM}	$V_{GS} = 18\text{ V}$		174	A
Gate-source voltage, max. transient voltage	V_{GS}	$t_p \leq 0.5\text{ }\mu\text{s}$, $D < 0.01$		-10...25	V
Gate-source voltage, max. static voltage ²⁾	V_{GS}			-7...23	V
Avalanche energy, single pulse	E_{AS}	$I_D = 32.1\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 0.8\text{ mH}$, $T_{vj(start)} = 25\text{ °C}$		401	mJ
Avalanche energy, repetitive	E_{AR}	$I_D = 32.1\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 3.9\text{ }\mu\text{H}$, $T_{vj(start)} = 25\text{ °C}$		2	mJ
Short-circuit withstand time	t_{SC}	$V_{DD} \leq 800\text{ V}$, $V_{DS,peak} < 1400\text{ V}$, $V_{GS(on)} = 15\text{ V}$, $T_{vj(start)} = 25\text{ °C}$		2	μs
Power dissipation, limited by $T_{vj(max)}$	P_{tot}	$T_c = 25\text{ °C}$		326	W
		$T_c = 100\text{ °C}$		163	

1) Verified by design

2) The maximum gate-source voltage in the application design should be in accordance to IPC-9592B.

Table 3 Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
Recommended turn-on gate voltage	$V_{GS(on)}$		15...18	V
Recommended turn-off gate voltage	$V_{GS(off)}$		-5...0	V

Table 4 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Drain-source on-state resistance	$R_{DS(on)}$	$I_D = 32.1\text{ A}$		$T_{vj} = 25\text{ °C}$, $V_{GS(on)} = 18\text{ V}$	24	mΩ
				$T_{vj} = 150\text{ °C}$, $V_{GS(on)} = 18\text{ V}$	51.6	
				$T_{vj} = 175\text{ °C}$, $V_{GS(on)} = 18\text{ V}$	60	
				$T_{vj} = 25\text{ °C}$, $V_{GS(on)} = 15\text{ V}$	30	
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 10.1\text{ mA}$, $V_{DS} = V_{GS}$ (tested after 1 ms pulse at $V_{GS} = 20\text{ V}$)		$T_{vj} = 25\text{ °C}$	3.5	V
				$T_{vj} = 175\text{ °C}$	4.2	
Zero gate-voltage drain current	I_{DSS}	$V_{DS} = 1400\text{ V}$, $V_{GS} = 0\text{ V}$		$T_{vj} = 25\text{ °C}$		μA
				$T_{vj} = 175\text{ °C}$	240	
Gate leakage current	I_{GSS}	$V_{DS} = 0\text{ V}$		$V_{GS} = 23\text{ V}$		nA
				$V_{GS} = -10\text{ V}$	120	
Forward transconductance	g_{fs}	$I_D = 32.1\text{ A}$, $V_{DS} = 20\text{ V}$			22	S
Internal gate resistance	$R_{G,int}$	$f = 1\text{ MHz}$, $V_{AC} = 25\text{ mV}$			2.5	Ω
Input capacitance	C_{iss}	$V_{DS} = 1000\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 100\text{ kHz}$, $V_{AC} = 25\text{ mV}$			2290	pF
Output capacitance	C_{oss}	$V_{DS} = 1000\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 100\text{ kHz}$, $V_{AC} = 25\text{ mV}$			78	pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 1000\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 100\text{ kHz}$, $V_{AC} = 25\text{ mV}$			7.1	pF
C_{oss} stored energy	E_{oss}	$V_{DS} = 1000\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 100\text{ kHz}$, $V_{AC} = 25\text{ mV}$, Calculated based on C_{oss}			50	μJ
Output charge	Q_{oss}	$V_{DS} = 1000\text{ V}$, $V_{GS} = 0\text{ V}$, Calculated based on C_{oss}			137	nC
Effective output capacitance, energy related	$C_{o(er)}$	$V_{DS} = 0...1000\text{ V}$, $V_{GS} = 0\text{ V}$			155	pF

(table continues...)

Table 4 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Effective output capacitance, time related	$C_{o(tr)}$	$I_D = \text{constant}, V_{DS} = 0 \dots 1000 \text{ V}, V_{GS} = 0 \text{ V}$		171		pF
Total gate charge	Q_G	$V_{DD} = 1000 \text{ V}, I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V}, \text{turn-on pulse}$		72		nC
Plateau gate charge	$Q_{GS(pl)}$	$V_{DD} = 1000 \text{ V}, I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V}, \text{turn-on pulse}$		23.8		nC
Gate-to-drain charge	Q_{GD}	$V_{DD} = 1000 \text{ V}, I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V}, \text{turn-on pulse}$		14		nC
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 1000 \text{ V},$ $I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V},$ $R_{GS(on)} = 2.3 \Omega,$ $R_{GS(off)} = 2.3 \Omega,$ $L_\sigma = 12 \text{ nH}, \text{diode: body diode at } V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	8		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	6.8		
Rise time	t_r	$V_{DD} = 1000 \text{ V},$ $I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V},$ $R_{GS(on)} = 2.3 \Omega,$ $R_{GS(off)} = 2.3 \Omega,$ $L_\sigma = 12 \text{ nH}, \text{diode: body diode at } V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	4.1		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	3.8		
Turn-off delay time	$t_{d(off)}$	$V_{DD} = 1000 \text{ V},$ $I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V},$ $R_{GS(on)} = 2.3 \Omega,$ $R_{GS(off)} = 2.3 \Omega,$ $L_\sigma = 12 \text{ nH}, \text{diode: body diode at } V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	18		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	20		
Fall time	t_f	$V_{DD} = 1000 \text{ V},$ $I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V},$ $R_{GS(on)} = 2.3 \Omega,$ $R_{GS(off)} = 2.3 \Omega,$ $L_\sigma = 12 \text{ nH}, \text{diode: body diode at } V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	7.6		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	8.3		
Turn-on energy	E_{on}	$V_{DD} = 1000 \text{ V},$ $I_D = 32.1 \text{ A}, V_{GS} = 0/18 \text{ V},$ $R_{GS(on)} = 2.3 \Omega,$ $R_{GS(off)} = 2.3 \Omega,$ $L_\sigma = 12 \text{ nH}, \text{diode: body diode at } V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	412		μJ
			$T_{vj} = 175 \text{ }^\circ\text{C}$	903		

(table continues...)

3 Body diode (MOSFET)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off energy	E_{off}	$V_{DD} = 1000\text{ V}$, $I_D = 32.1\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 12\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	78		μJ
			$T_{vj} = 175\text{ °C}$	104		
Total switching energy ¹⁾	E_{tot}	$V_{DD} = 1000\text{ V}$, $I_D = 32.1\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 12\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	670		μJ
			$T_{vj} = 175\text{ °C}$	1600		
Virtual junction temperature	T_{vj}		-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h ²⁾			200	$^{\circ}\text{C}$

1) including E_{fr}

2) up to 5000 cycles. Maximum ΔT limited to 100 K.

Note: The chip technology was characterized up to 200 kV/ μs . The measured dV/dt was limited by measurement test setup and package.

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

3 Body diode (MOSFET)

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} \geq 25\text{ °C}$	1400	V
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	$V_{GS} = 0\text{ V}$	174	A

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{SD} = 32.1\text{ A}$, $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	4.2	5.5	V
			$T_{vj} = 100\text{ °C}$	4.11		
			$T_{vj} = 175\text{ °C}$	4.05		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
MOSFET forward recovery charge	Q_{fr}	$V_{DD} = 1000 \text{ V}$, $I_{SD} = 32.1 \text{ A}$, $V_{GS} = 0 \text{ V}$, $-di_{SD}/dt = 1000 \text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	0.12		μC
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	0.91		
MOSFET peak forward recovery current	I_{frm}	$V_{DD} = 1000 \text{ V}$, $I_{SD} = 32.1 \text{ A}$, $V_{GS} = 0 \text{ V}$, $-di_{SD}/dt = 1000 \text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	8.6		A
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	16		
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 1000 \text{ V}$, $I_{SD} = 32.1 \text{ A}$, $V_{GS} = 0 \text{ V}$, $-di_{SD}/dt = 1000 \text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	180		μJ
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	590		
Virtual junction temperature	T_{vj}		-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h ¹⁾			200	$^{\circ}\text{C}$

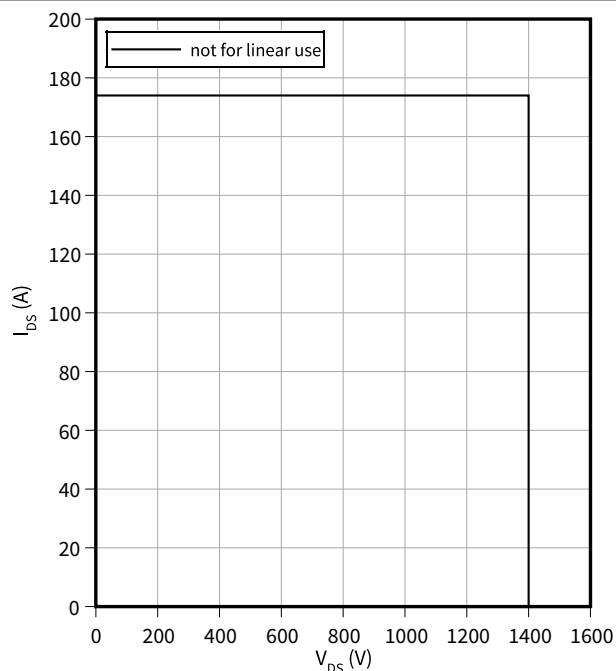
1) up to 5000 cycles. Maximum ΔT limited to 100 K.

4 Characteristics diagrams

Reverse bias safe operating area (RBSOA)

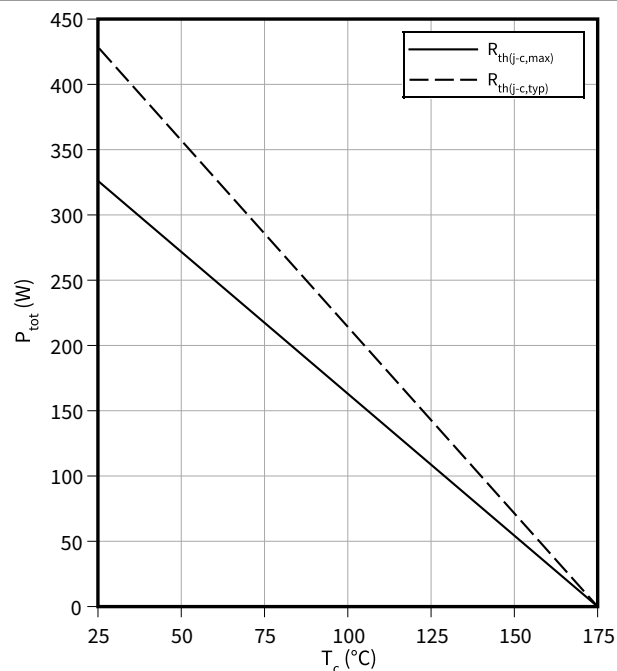
$$I_{DS} = f(V_{DS})$$

$$T_{vj} \leq 200\text{ }^{\circ}\text{C}, V_{GS} = 0/18\text{ V}, T_c = 25\text{ }^{\circ}\text{C}$$



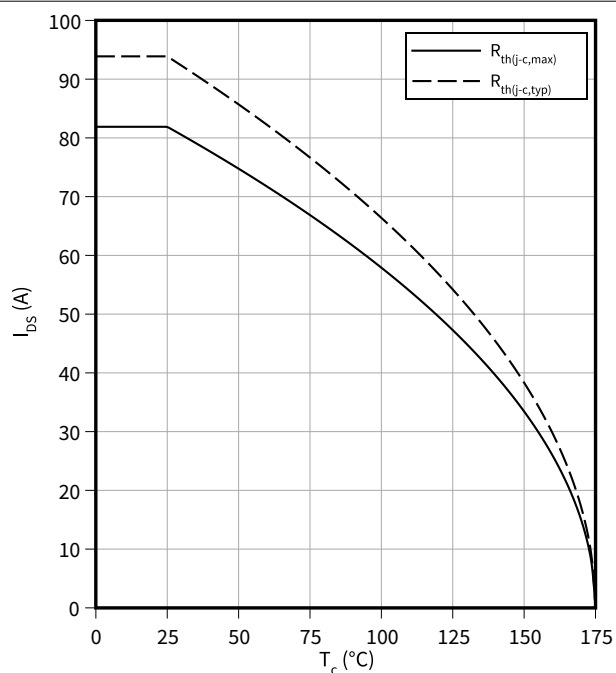
Power dissipation as a function of case temperature limited by bond wire

$$P_{tot} = f(T_c)$$



Maximum DC drain to source current as a function of case temperature limited by bond wire

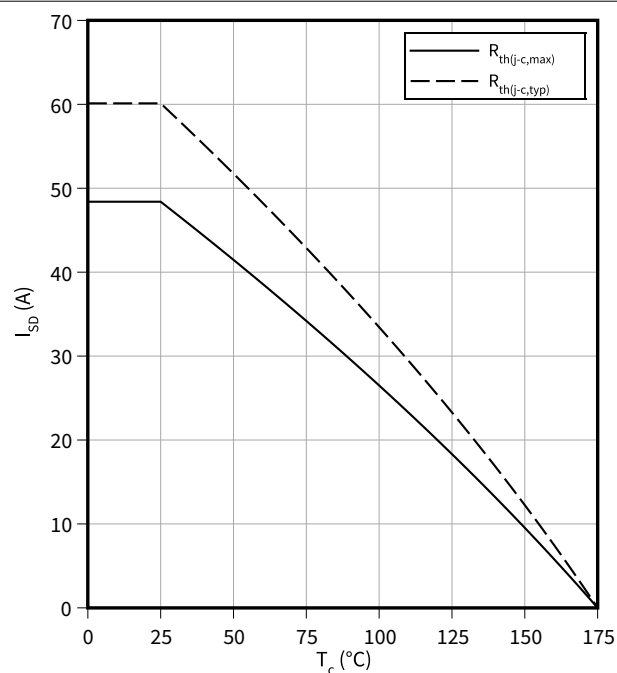
$$I_{DS} = f(T_c)$$



Maximum source to drain current as a function of case temperature limited by bond wire

$$I_{SD} = f(T_c)$$

$$V_{GS} = 0\text{ V}$$

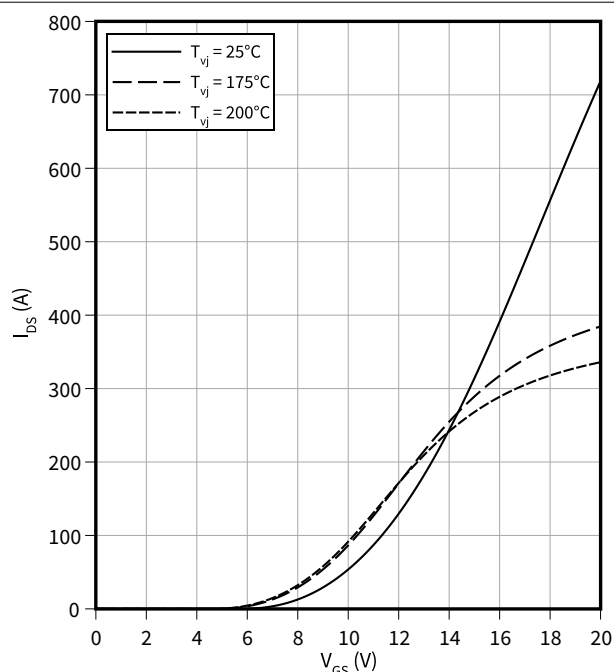


4 Characteristics diagrams

Typical transfer characteristic

$$I_{DS} = f(V_{GS})$$

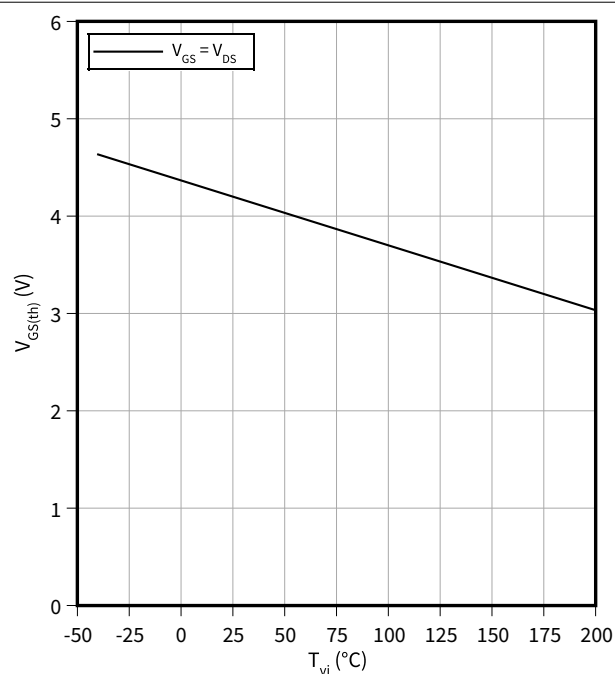
$$V_{DS} = 20 \text{ V}, t_p = 20 \mu\text{s}$$



Typical gate-source threshold voltage as a function of junction temperature

$$V_{GS(th)} = f(T_{vj})$$

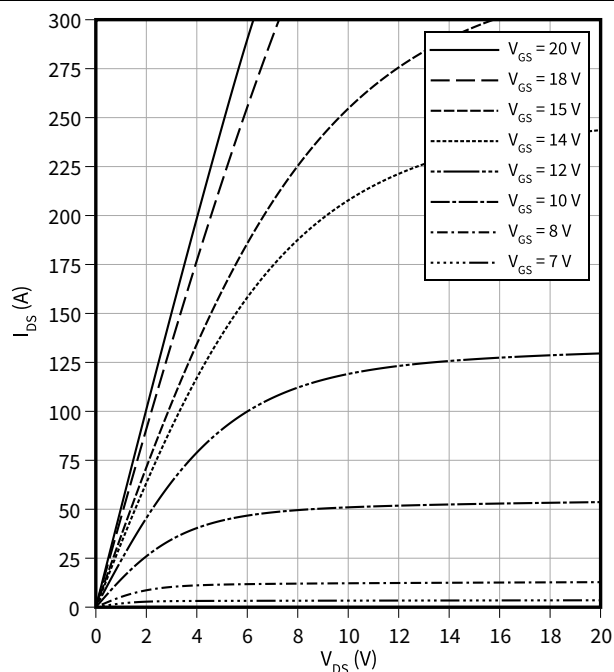
$$I_D = 10.1 \text{ mA}$$



Typical output characteristic, V_{GS} as a parameter

$$I_{DS} = f(V_{DS})$$

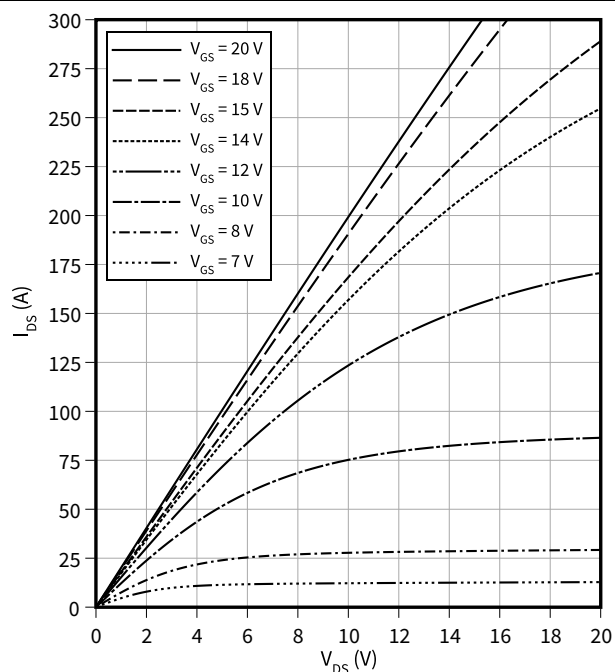
$$T_{vj} = 25^\circ\text{C}, t_p = 20 \mu\text{s}$$



Typical output characteristic, V_{GS} as a parameter

$$I_{DS} = f(V_{DS})$$

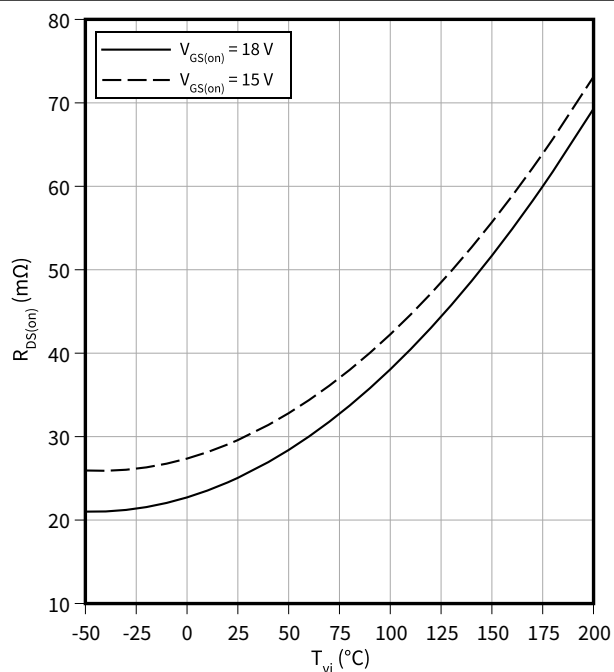
$$T_{vj} = 175^\circ\text{C}, t_p = 20 \mu\text{s}$$



4 Characteristics diagrams

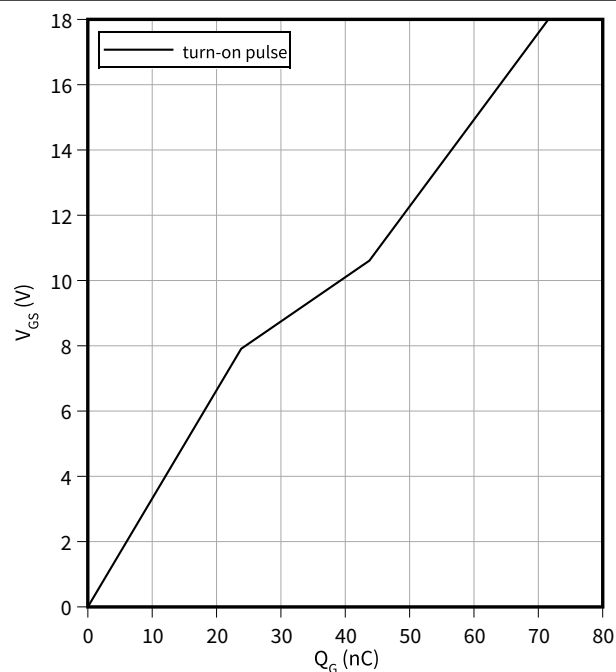
Typical on-state resistance as a function of junction temperature

$R_{DS(on)} = f(T_{vj})$
 $I_D = 32.1 \text{ A}$



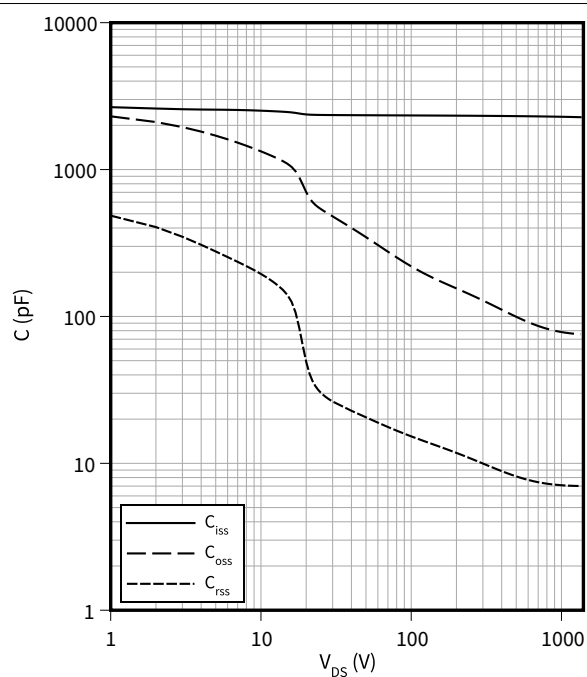
Typical gate charge

$V_{GS} = f(Q_G)$
 $I_D = 32.1 \text{ A}, V_{DS} = 1000 \text{ V}$



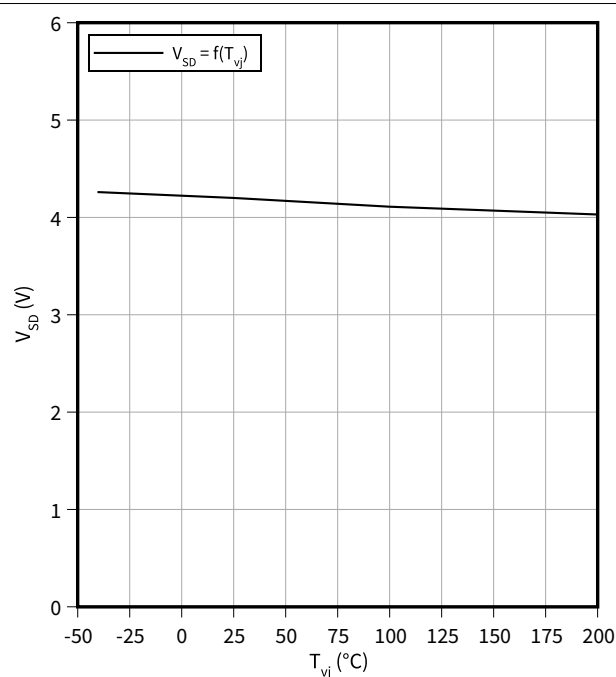
Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$
 $f = 100 \text{ kHz}, V_{GS} = 0 \text{ V}$



Typical reverse drain voltage as a function of junction temperature

$V_{SD} = f(T_{vj})$
 $I_{SD} = 32.1 \text{ A}, V_{GS} = 0 \text{ V}$

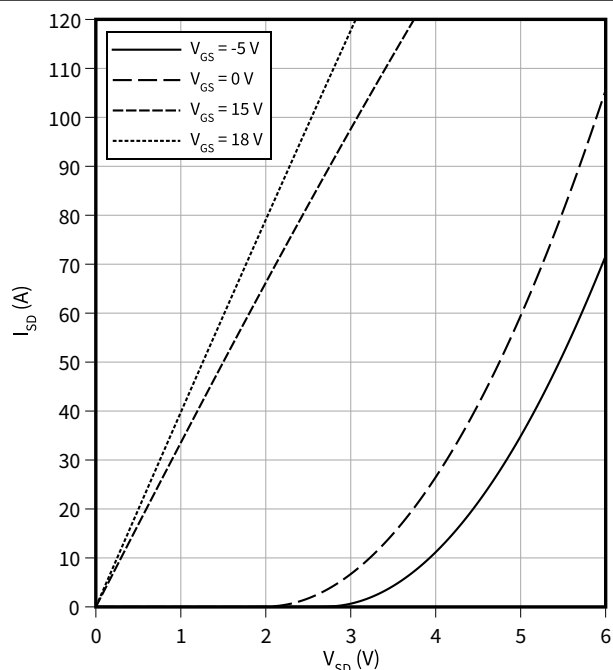


4 Characteristics diagrams

Typical reverse drain current as a function of reverse drain voltage, V_{GS} as a parameter

$$I_{SD} = f(V_{SD})$$

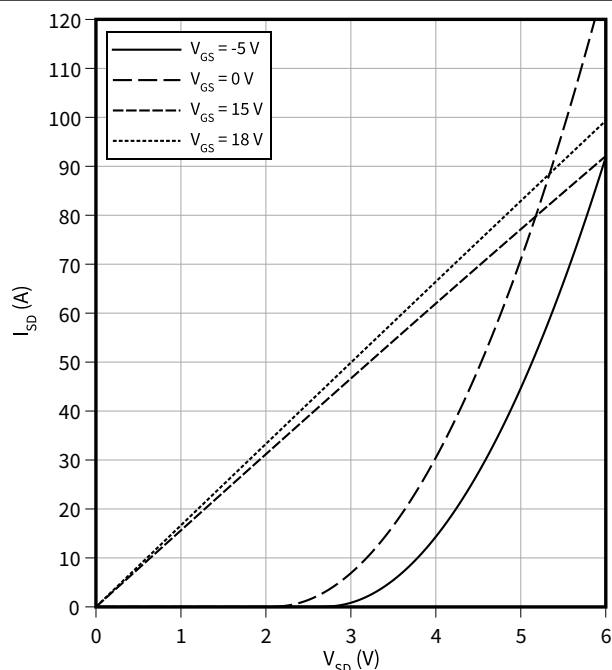
$T_{vj} = 25\text{ °C}$, $t_p = 20\text{ }\mu\text{s}$



Typical reverse drain current as a function of reverse drain voltage, V_{GS} as a parameter

$$I_{SD} = f(V_{SD})$$

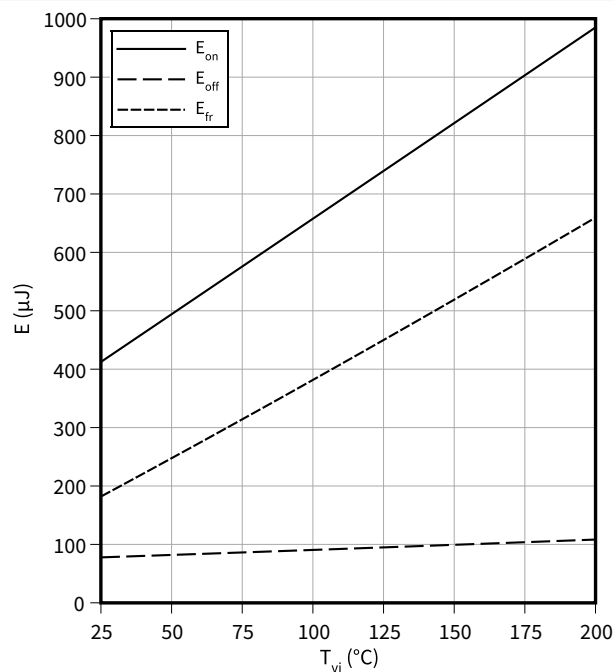
$T_{vj} = 175\text{ °C}$, $t_p = 20\text{ }\mu\text{s}$



Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

$$E = f(T_{vj})$$

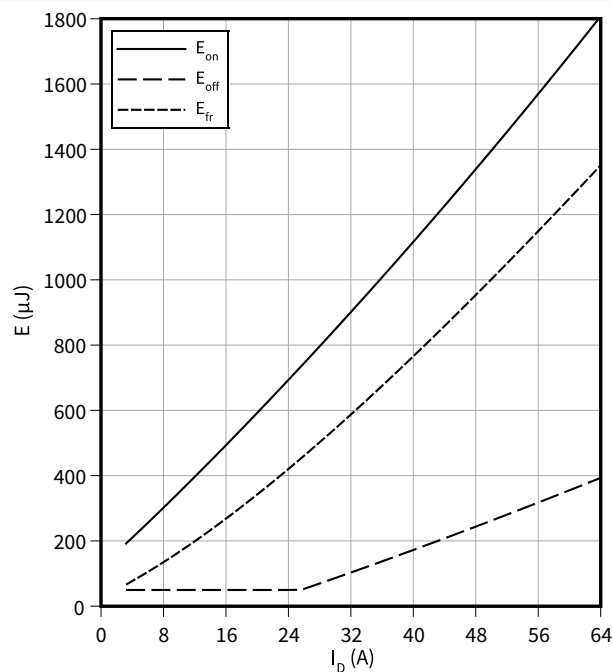
$V_{GS} = 0/18\text{ V}$, $I_D = 32.1\text{ A}$, $R_{G,ext} = 2.3\text{ }\Omega$, $V_{DD} = 1000\text{ V}$



Typical switching energy as a function of drain current, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

$$E = f(I_D)$$

$V_{GS} = 0/18\text{ V}$, $T_{vj} = 175\text{ °C}$, $R_{G,ext} = 2.3\text{ }\Omega$, $V_{DD} = 1000\text{ V}$

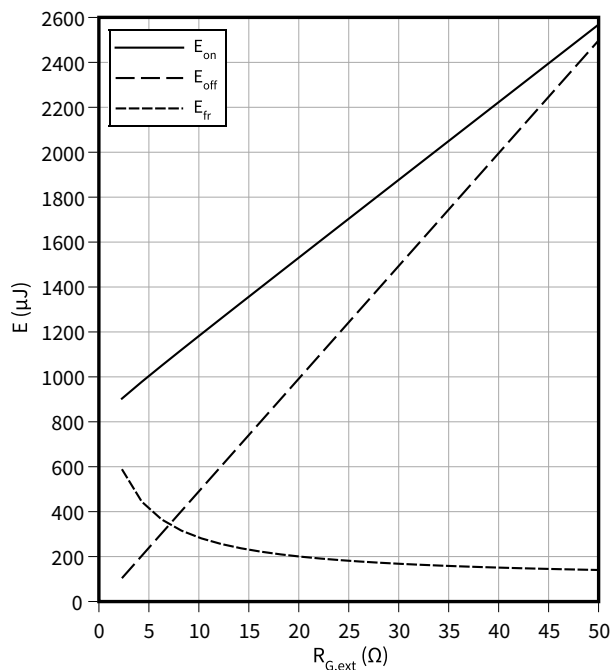


4 Characteristics diagrams

Typical switching energy as a function of gate resistance, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0$ V

$$E = f(R_{G,ext})$$

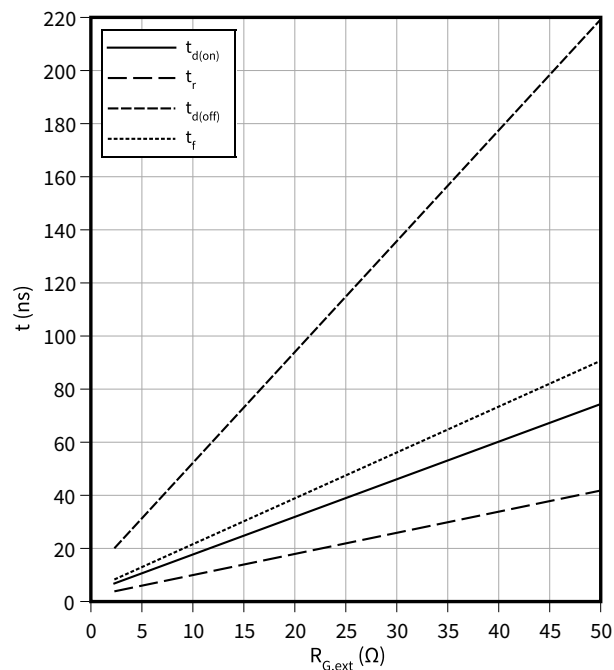
$V_{GS} = 0/18$ V, $I_D = 32.1$ A, $T_{vj} = 175$ °C, $V_{DD} = 1000$ V



Typical switching times as a function of gate resistance, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0$ V

$$t = f(R_{G,ext})$$

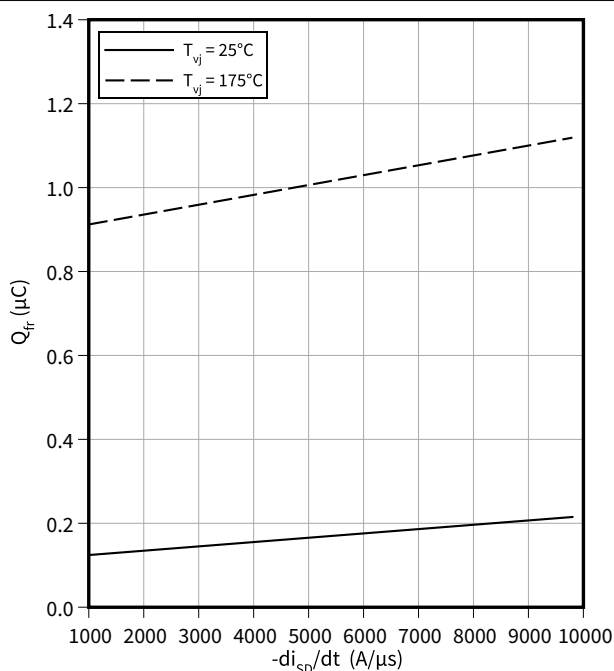
$V_{GS} = 0/18$ V, $I_D = 32.1$ A, $T_{vj} = 175$ °C, $V_{DD} = 1000$ V



Typical reverse recovery charge as a function of reverse drain current slope, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0$ V

$$Q_{fr} = f(-di_{SD}/dt)$$

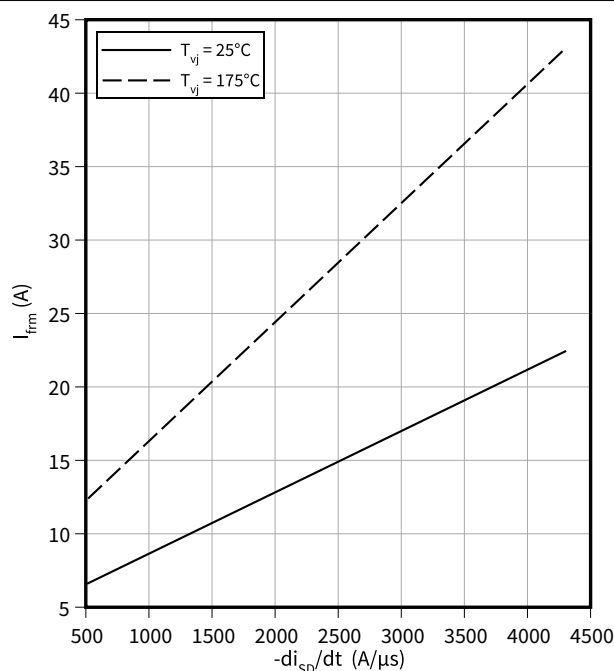
$V_{GS} = 0/18$ V, $I_{SD} = 32.1$ A, $V_{DD} = 1000$ V



Typical reverse recovery current as a function of reverse drain current slope, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0$ V

$$I_{frm} = f(-di_{SD}/dt)$$

$V_{GS} = 0/18$ V, $I_{SD} = 32.1$ A, $V_{DD} = 1000$ V



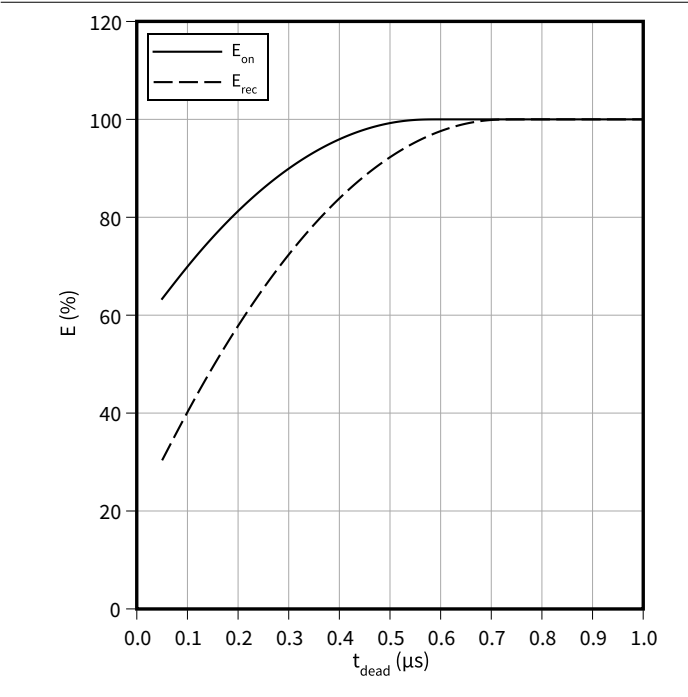
4 Characteristics diagrams

Typical switching energy as a function of dead time / blanking time, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = -5\text{ V}$

$E = f(t_{dead})$

$I_D = 32.1\text{ A}$, $T_{vj} = 175\text{ °C}$, $R_{G,ext} = 2.3\text{ }\Omega$, $V_{GS} = 0/18\text{ V}$

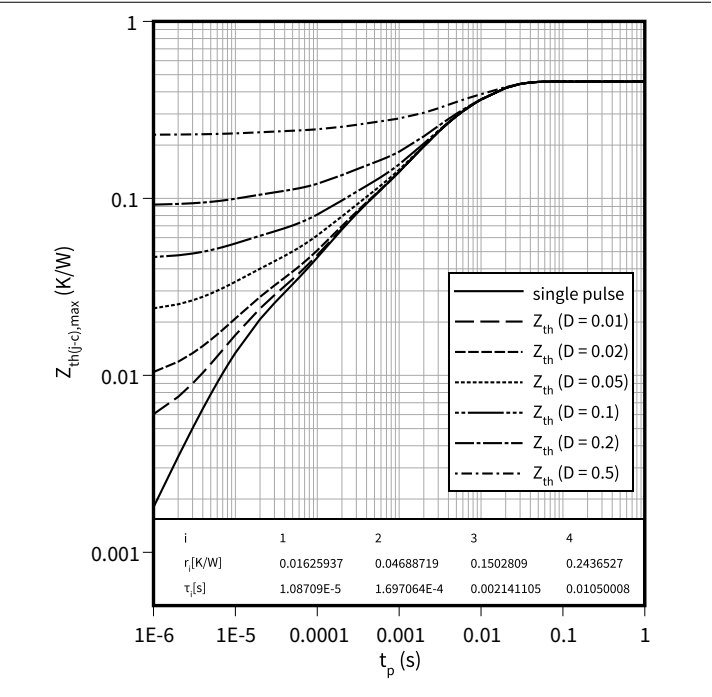
$V_{DD} = 1000\text{ V}$



Max. transient thermal impedance (MOSFET/diode)

$Z_{th(j-c),max} = f(t_p)$

$D = t_p/T$



5 Package outlines

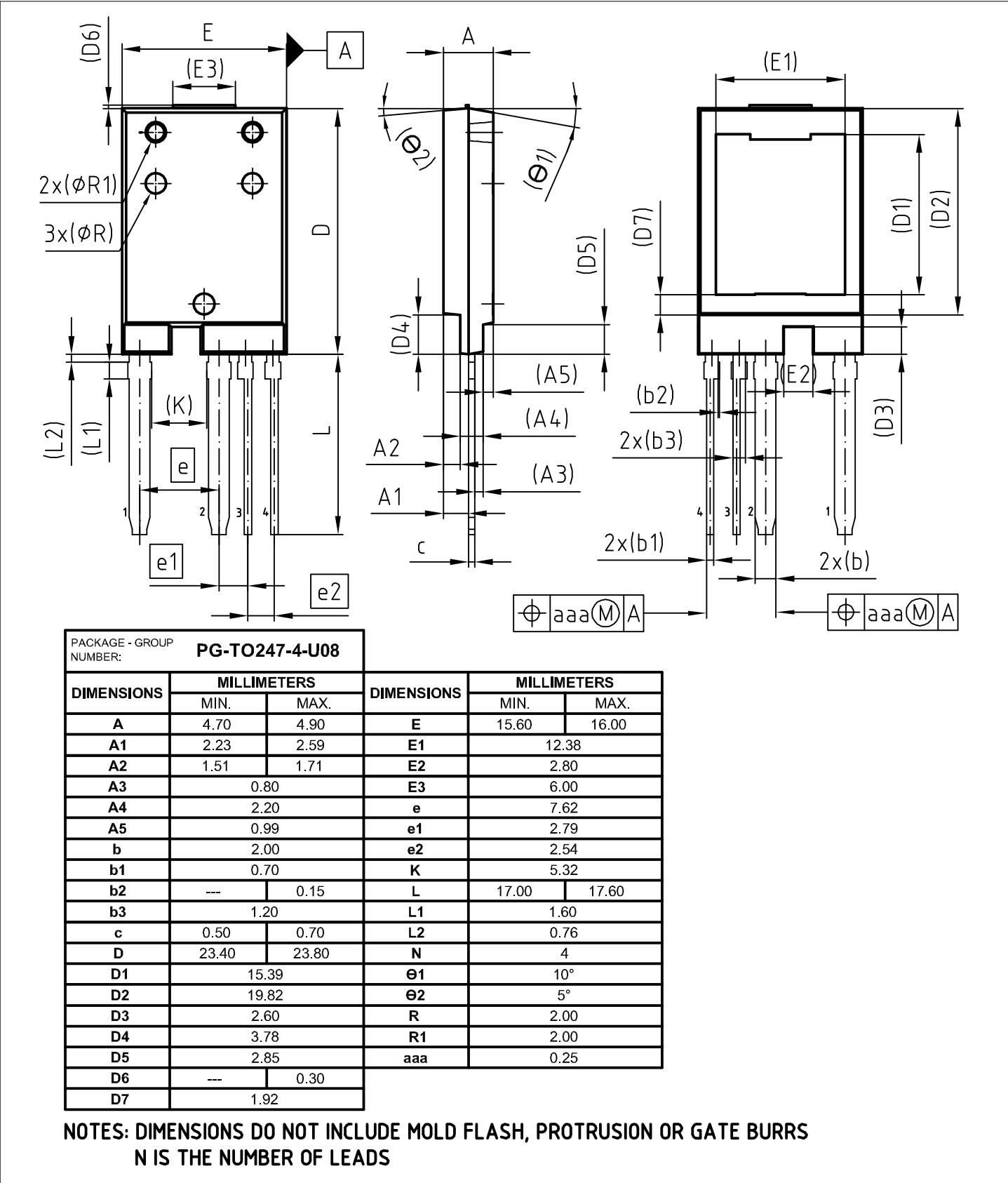


Figure 1

6 Testing conditions

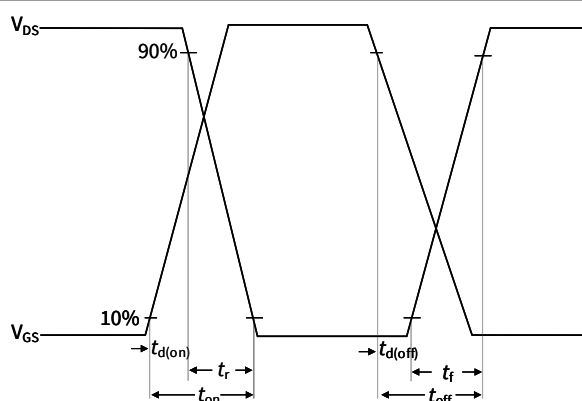


Figure A. Definition of switching times

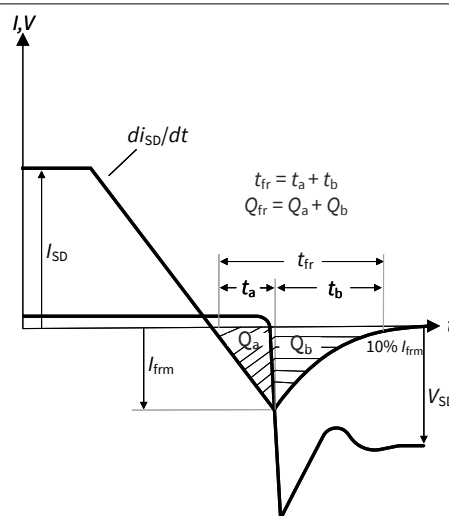


Figure B. Definition of body diode switching characteristics

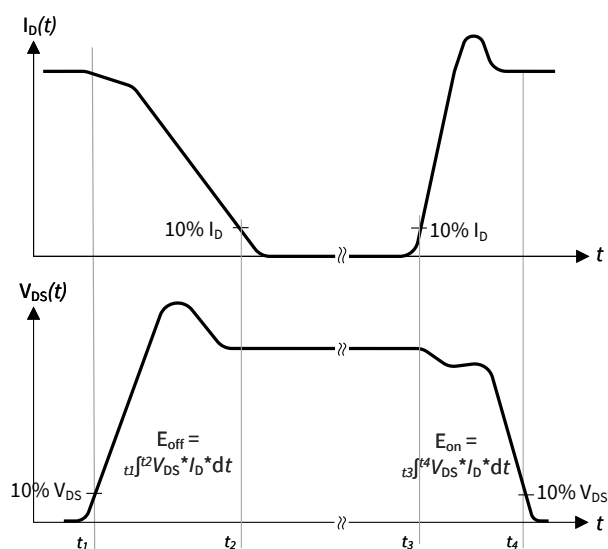


Figure C. Definition of switching losses

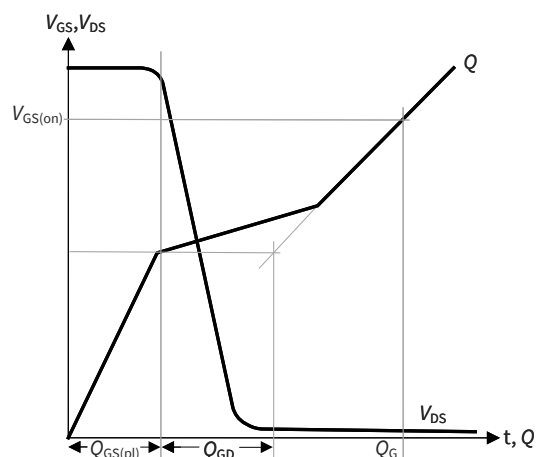


Figure D. Definition of QGD

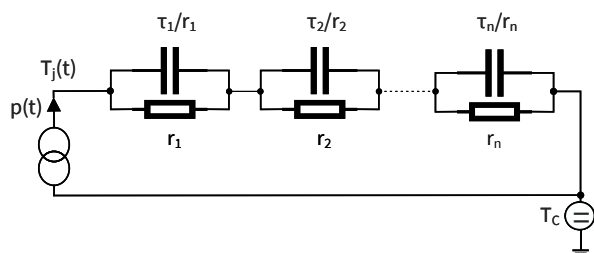


Figure E. Thermal equivalent circuit

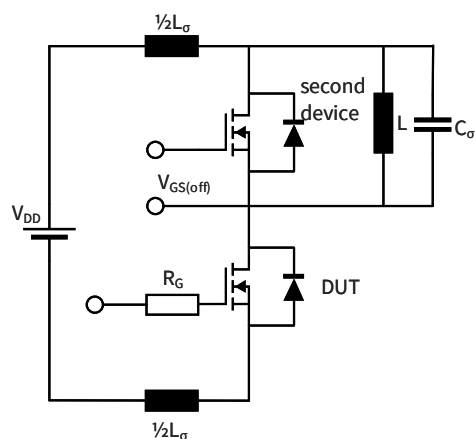


Figure F. Dynamic test circuit

Parasitic inductance L_σ ,
Parasitic capacitor C_σ ,



Revision history

Revision history

Document revision	Date of release	Description of changes
1.00	2025-02-25	Final datasheet

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