

CoolMOS™ Power Transistor
Features

- Lowest figure of merit $R_{ON} \times Q_g$
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications

Product Summary

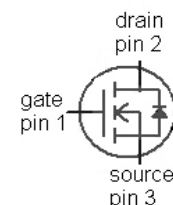
$V_{DS} @ T_{jmax}$	550	V
$R_{DS(on),max}$	0.350	Ω
$Q_{g,typ}$	19	nC

CoolMOS CP is specially designed for:

- Hard and softswitching SMPS for server power supplies
- CCM PFC for Notebook adapter, PDP and LCD TV
- PWM for Notebook adapter, PDP and LCD TV

PG-TO262


Type	Package	Marking
IPI50R350CP	PG-TO262	5R350CP


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ }^\circ\text{C}$	10	A
		$T_C=100\text{ }^\circ\text{C}$	6	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25\text{ }^\circ\text{C}$	22	
Avalanche energy, single pulse	E_{AS}	$I_D=3.7\text{ A}$, $V_{DD}=50\text{ V}$	246	mJ
Avalanche energy, repetitive t_{AR} ^{2),3)}	E_{AR}	$I_D=3.7\text{ A}$, $V_{DD}=50\text{ V}$	0.37	
Avalanche current, repetitive t_{AR} ^{2),3)}	I_{AR}		3.7	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS}=0\dots400\text{ V}$	50	V/ns
Gate source voltage	V_{GS}	static	± 20	V
		AC ($f>1\text{ Hz}$)	± 30	
Power dissipation	P_{tot}	$T_C=25\text{ }^\circ\text{C}$	89	W
Operating and storage temperature	T_j , T_{stg}		-55 ... 150	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current	I_S	$T_C=25\text{ °C}$	5.6	A
Diode pulse current ²⁾	$I_{S,pulse}$		22	
Reverse diode dv/dt ⁴⁾	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	1.4	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	1.6 mm (0.063 in.) from case for 10 s	-	-	260	°C

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

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$	500	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$, $I_D=0.37\text{ mA}$	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=500\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$	-	-	1	μA
		$V_{DS}=500\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=150\text{ °C}$	-	10	-	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}$, $I_D=5.6\text{ A}$, $T_j=25\text{ °C}$	-	0.32	0.35	Ω
		$V_{GS}=10\text{ V}$, $I_D=5.6\text{ A}$, $T_j=150\text{ °C}$	-	0.80	-	
Gate resistance	R_G	$f=1\text{ MHz}$, open drain	-	2.2	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=100\text{ V},$ $f=1\text{ MHz}$	-	1020	-	pF
Output capacitance	C_{oss}		-	46	-	
Effective output capacitance, energy related ⁵⁾	$C_{o(er)}$	$V_{GS}=0\text{ V}, V_{DS}=0\text{ V}$ to 400 V	-	43	-	
Effective output capacitance, time related ⁶⁾	$C_{o(tr)}$		-	92	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=400\text{ V},$ $V_{GS}=10\text{ V}, I_D=5.6\text{ A},$ $R_G=30.9\ \Omega$	-	35	-	ns
Rise time	t_r		-	14	-	
Turn-off delay time	$t_{d(off)}$		-	80	-	
Fall time	t_f		-	12	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DD}=400\text{ V}, I_D=5.6\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	4	-	nC
Gate to drain charge	Q_{gd}		-	6	-	
Gate charge total	Q_g		-	19	25	
Gate plateau voltage	$V_{plateau}$		-	5.2	-	V

Reverse Diode

Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=5.6\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.9	1.2	V
Reverse recovery time	t_{rr}	$V_R=400\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	250	-	ns
Reverse recovery charge	Q_{rr}		-	2.3	-	μC
Peak reverse recovery current	I_{rrm}		-	19	-	A

¹⁾ J-STD20 and JESD22

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

³⁾ Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR} \cdot f$.

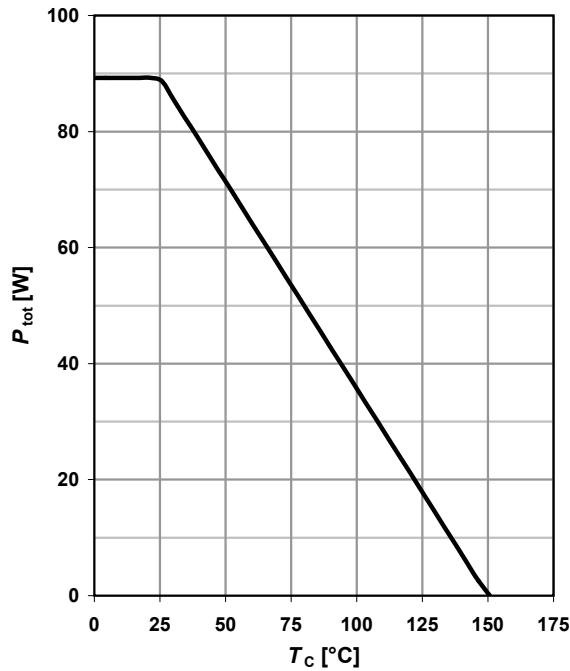
⁴⁾ $I_{SD} \leq I_D, di/dt \leq 400\text{ A}/\mu\text{s}, V_{DClink}=400\text{ V}, V_{peak} < V_{(BR)DSS}, T_j < T_{j,max}$, identical low and high side switch

⁵⁾ $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

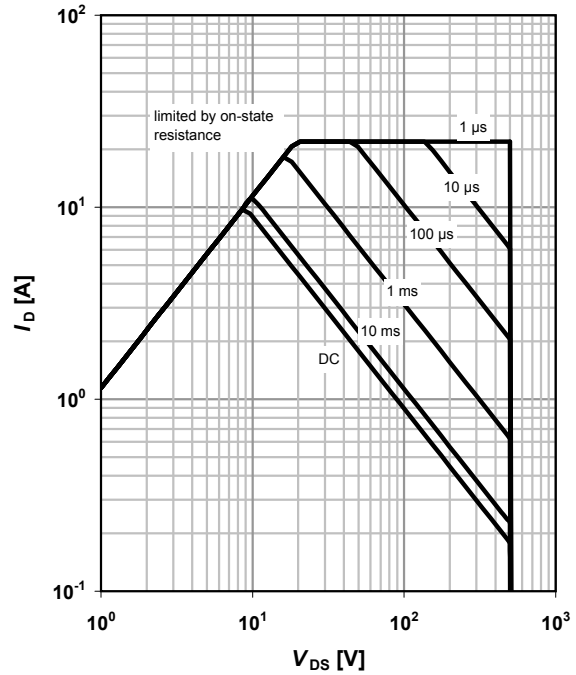
⁶⁾ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

1 Power dissipation

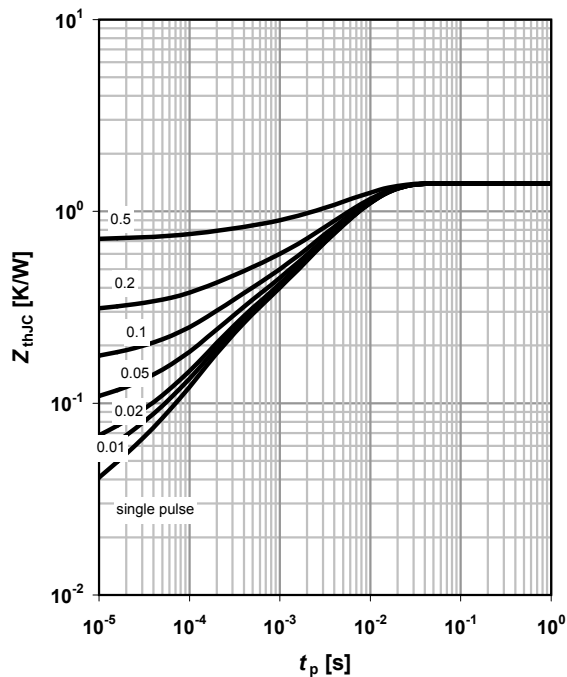
$$P_{\text{tot}} = f(T_C)$$


2 Safe operating area

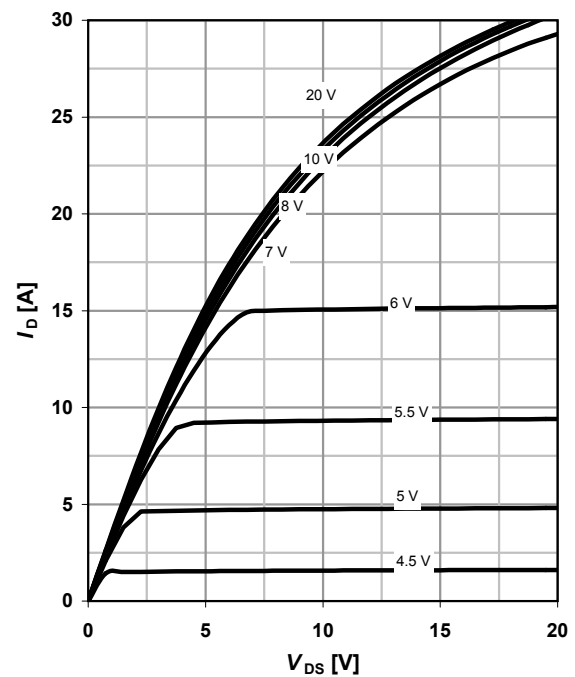
$$I_D = f(V_{DS}); T_C = 25^\circ\text{C}; D = 0$$

 parameter: t_p

3 Max. transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

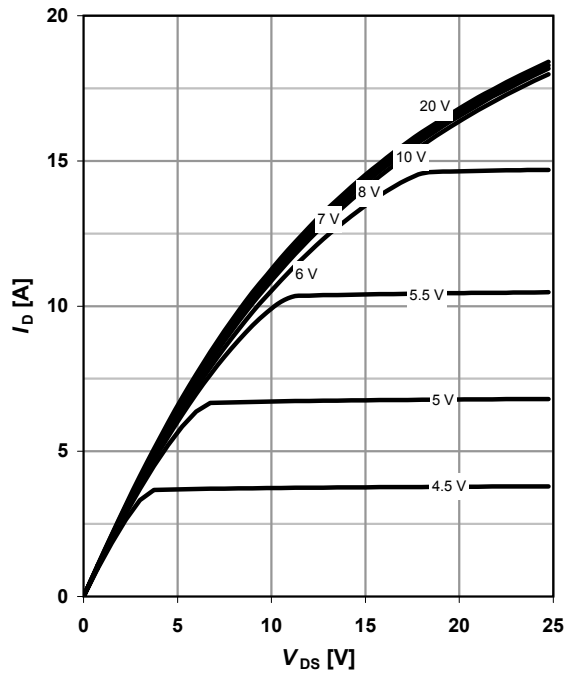
 parameter: $D = t_p / T$

4 Typ. output characteristics

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

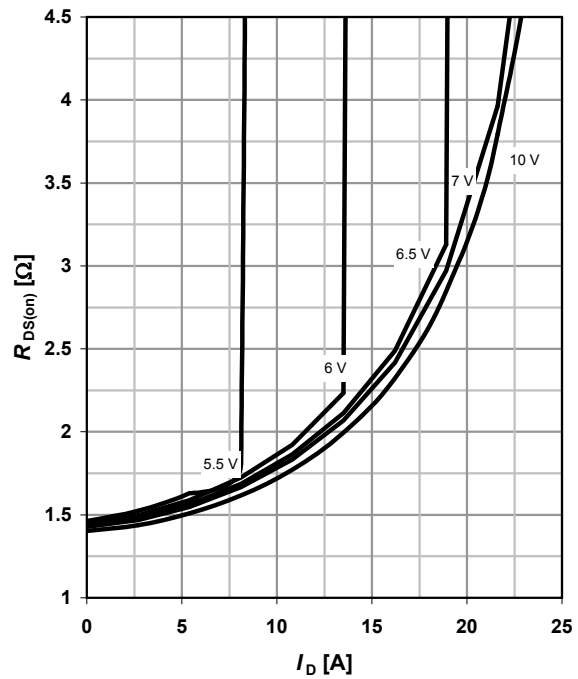
 parameter: V_{GS}


5 Typ. output characteristics

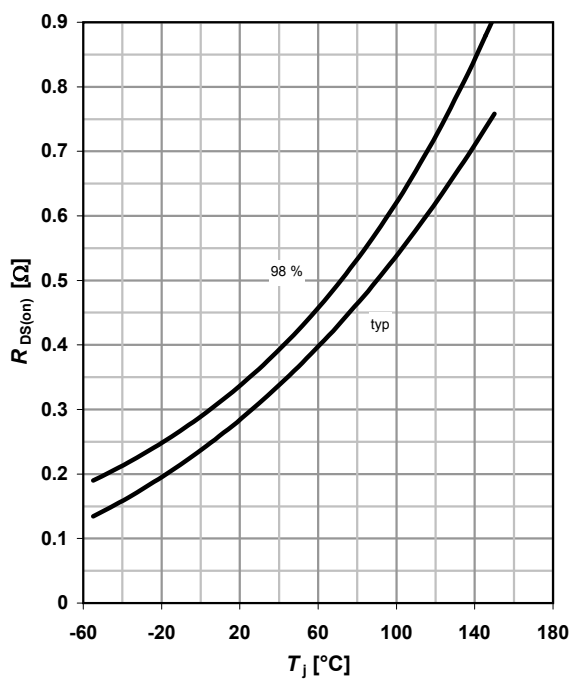
$$I_D = f(V_{DS}); T_j = 150\text{ }^\circ\text{C}$$

 parameter: V_{GS}

6 Typ. drain-source on-state resistance

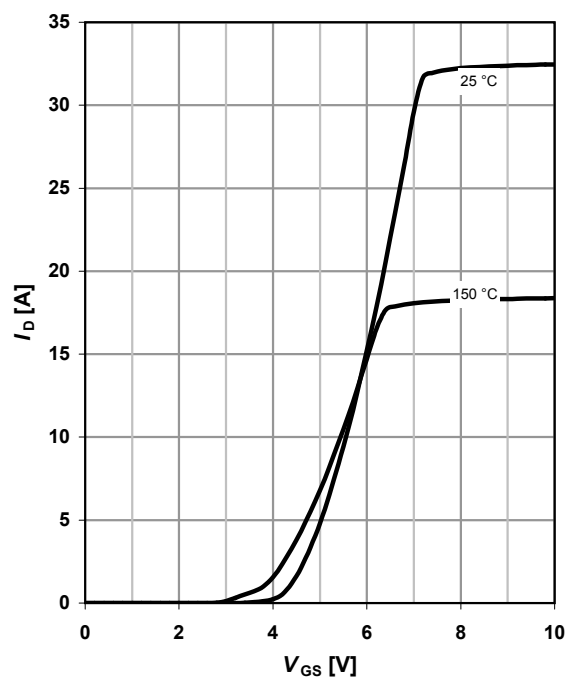
$$R_{DS(on)} = f(I_D); T_j = 150\text{ }^\circ\text{C}$$

 parameter: V_{GS}

7 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = 5.6\text{ A}; V_{GS} = 10\text{ V}$$

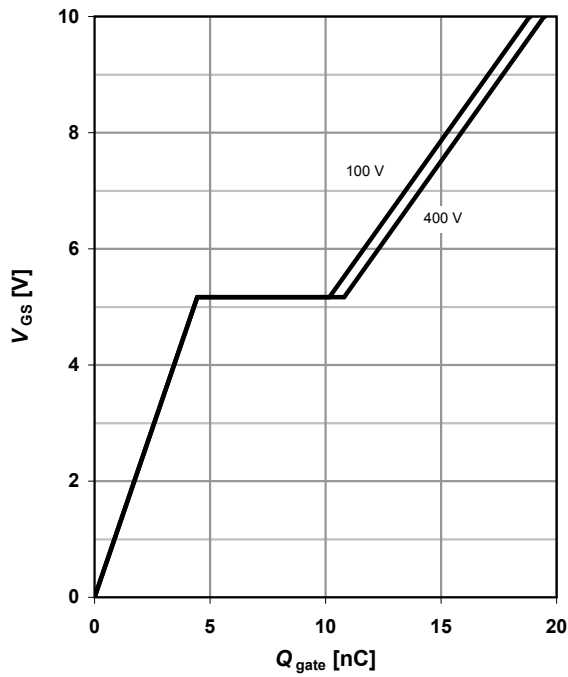

8 Typ. transfer characteristics

$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

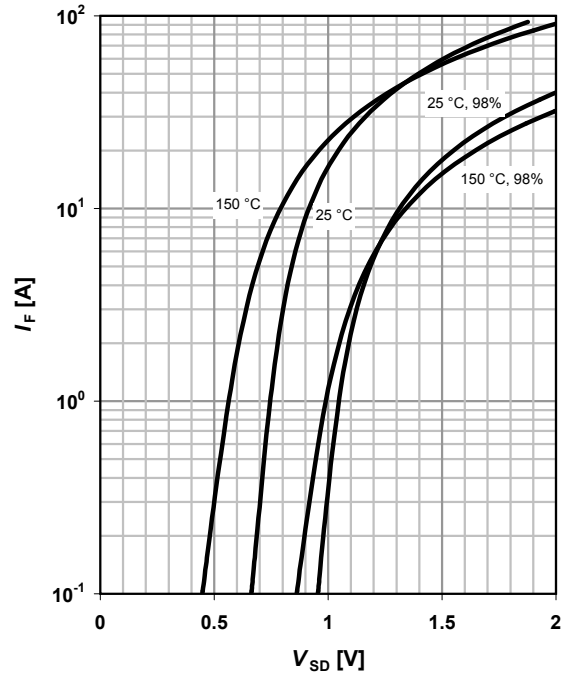
 parameter: T_j


9 Typ. gate charge

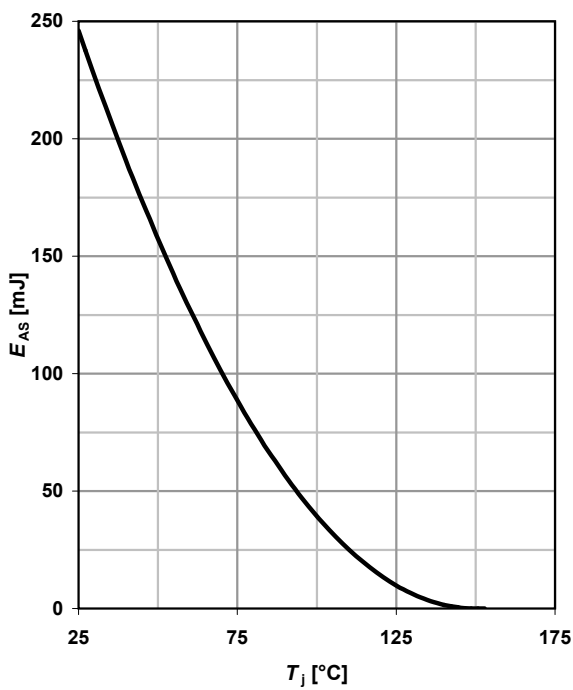
$$V_{GS} = f(Q_{gate}); I_D = 5.6 \text{ A pulsed}$$

 parameter: V_{DD}

10 Forward characteristics of reverse diode

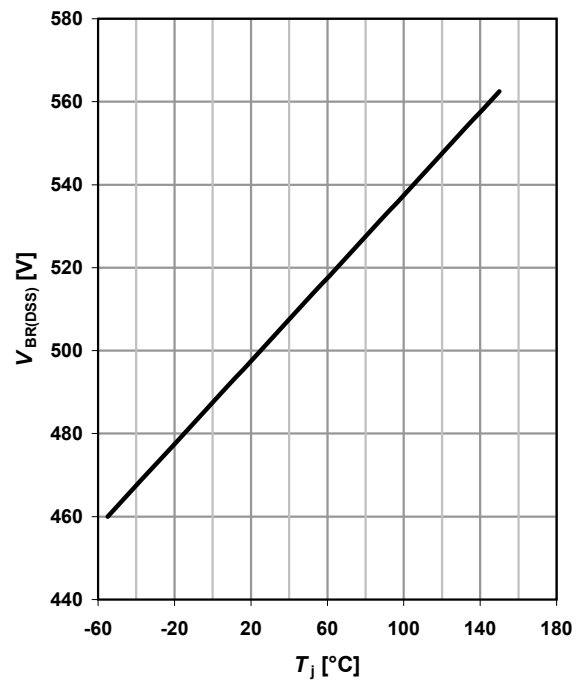
$$I_F = f(V_{SD})$$

 parameter: T_j

11 Avalanche energy

$$E_{AS} = f(T_j); I_D = 3.7 \text{ A}; V_{DD} = 50 \text{ V}$$

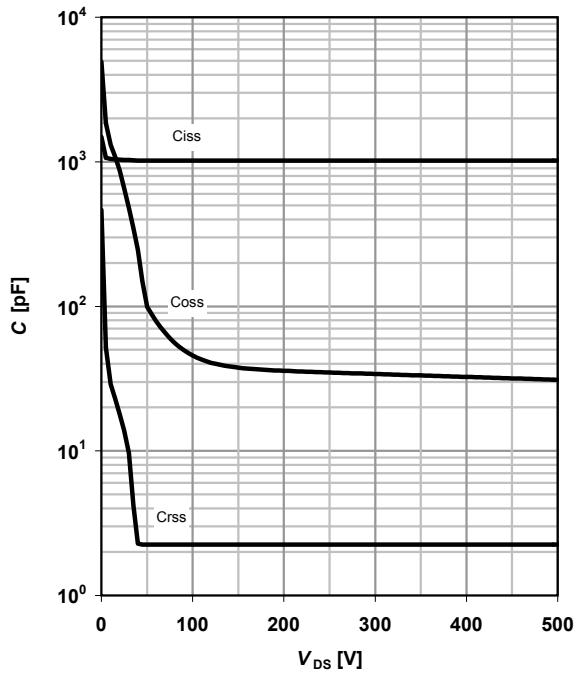

12 Drain-source breakdown voltage

$$V_{BR(DSS)} = f(T_j); I_D = 0.25 \text{ mA}$$



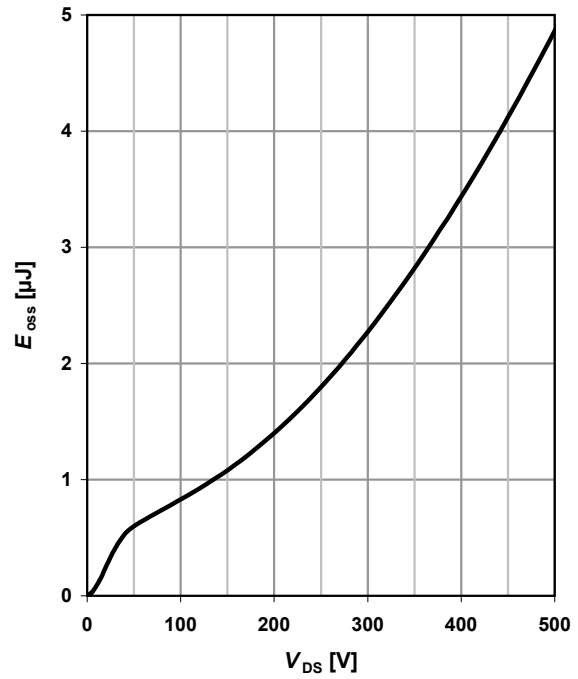
13 Typ. capacitances

$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$



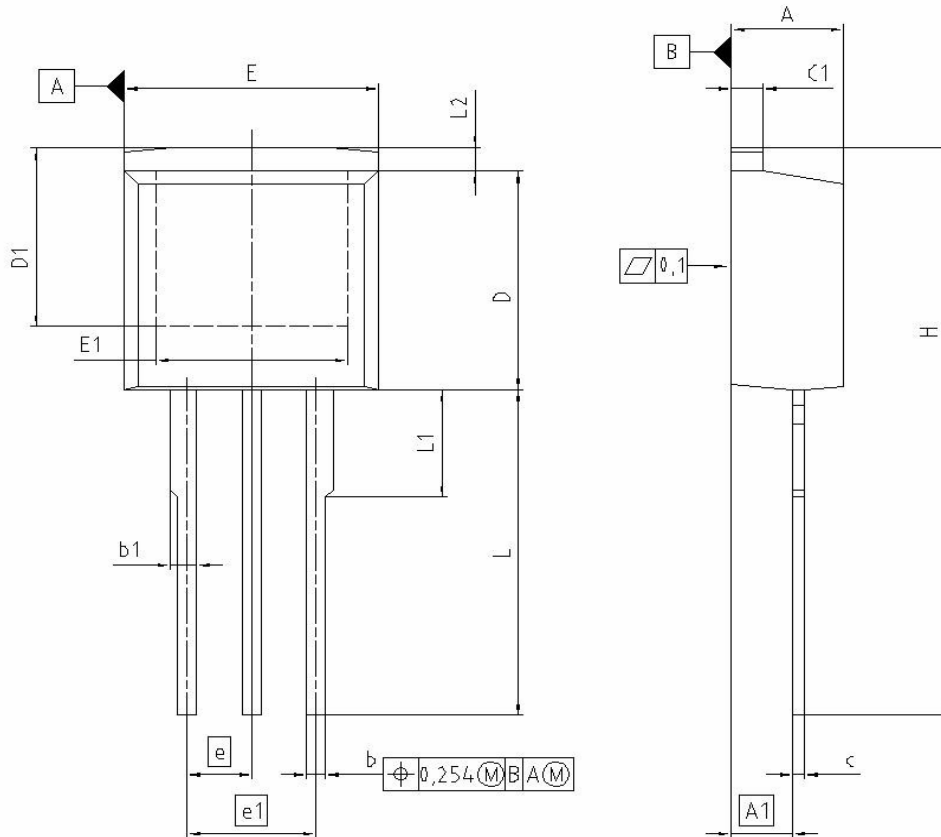
14 Typ. Coss stored energy

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



Definition of diode switching characteristics



PG-TO262-3-1: Outline


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.500	0.169	0.177
A1	2.150	2.650	0.085	0.104
b	0.650	0.850	0.026	0.033
b1	0.635	1.400	0.025	0.055
c	0.400	0.600	0.016	0.024
c1	1.170	1.370	0.046	0.054
D	9.050	9.450	0.356	0.372
D1	6.900	7.650	0.272	0.301
E	9.800	10.200	0.386	0.402
E1	7.250	8.600	0.285	0.339
e	2.540		0.100	
e1	5.080		0.200	
N	3		3	
L	13.000	14.000	0.512	0.551
L1	4.350	4.750	0.171	0.187
L2	0.700	1.300	0.028	0.051

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