

**CoolMOS™ Power Transistor**
**Features**

- Low gate charge
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant

**Product Summary**

$V_{DS}$	650	V
$R_{DS(on),max}$	0.28	$\Omega$
$Q_{g,typ}$	63	nC

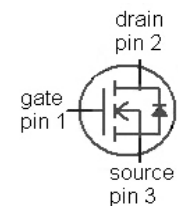
**CoolMOS C3 designed for:**

- Notebook Adapter

TO-262-3-1



Type	Package	Marking
SPI15N65C3	P-TO262-3-1	15N65C3


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}$	15	A
		$T_C=100\text{ °C}$	9.4	
Pulsed drain current <sup>3)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	45	
Avalanche energy, single pulse	$E_{AS}$	$I_D=3\text{ A}, V_{DD}=50\text{ V}$	460	mJ
Avalanche energy, repetitive $t_{AR}$ <sup>2),3)</sup>	$E_{AR}$	$I_D=5\text{ A}, V_{DD}=50\text{ V}$	0.8	
Avalanche current, repetitive $t_{AR}$ <sup>3),4)</sup>	$I_{AR}$		5.0	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS}=0\dots480\text{ V}$	50	V/ns
Gate source voltage	$V_{GS}$	static	$\pm 20$	V
		AC ( $f>1\text{ Hz}$ )	$\pm 30$	
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	156	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 <sup>2)</sup>	$I_S$	$T_C=25\text{ °C}$	15	A
Diode pulse current <sup>3)</sup>	$I_{S,pulse}$		45	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - case	$R_{thJC}$		-	-	0.8	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	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}$ , $I_D=250\text{ }\mu\text{A}$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ , $I_D=0.675\text{ mA}$	2.1	3	3.9	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=600\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$	-	0.5	25	$\mu\text{A}$
		$V_{DS}=600\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=150\text{ °C}$	-	25	-	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}$ , $I_D=9.4\text{ A}$ , $T_j=25\text{ °C}$	-	0.25	0.28	$\Omega$
		$V_{GS}=10\text{ V}$ , $I_D=9.4\text{ A}$ , $T_j=150\text{ °C}$	-	0.68	-	
Gate resistance	$R_G$	$f=1\text{ MHz}$ , open drain	-	1.4	-	$\Omega$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=25\text{ V},$ $f=1\text{ MHz}$	-	1600	-	pF
Output capacitance	$C_{oss}$		-	540	-	
Effective output capacitance, energy related <sup>5)</sup>	$C_{o(er)}$	$V_{GS}=0\text{ V}, V_{DS}=0\text{ V}$ to 480 V	-	67	-	
Effective output capacitance, time related <sup>6)</sup>	$C_{o(tr)}$		-	120	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=400\text{ V},$ $V_{GS}=10\text{ V}, I_D=15\text{ A},$ $R_G=6.8\ \Omega$	-	32	-	ns
Rise time	$t_r$		-	14	-	
Turn-off delay time	$t_{d(off)}$		-	70	-	
Fall time	$t_f$		-	11	-	

**Gate Charge Characteristics**

Gate to source charge	$Q_{gs}$	$V_{DD}=480\text{ V}, I_D=15\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	9	-	nC
Gate to drain charge	$Q_{gd}$		-	29	-	
Gate charge total	$Q_g$		-	63	-	
Gate plateau voltage	$V_{plateau}$		-	5.4	-	V

**Reverse Diode**

Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=15\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	1.0	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=480\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	420	-	ns
Reverse recovery charge	$Q_{rr}$		-	8	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	32	-	A

<sup>1)</sup> J-STD20 and JESD22

<sup>2)</sup> Limited only by maximum temperature.

<sup>3)</sup> Pulse width  $t_p$  limited by  $T_{j,max}$

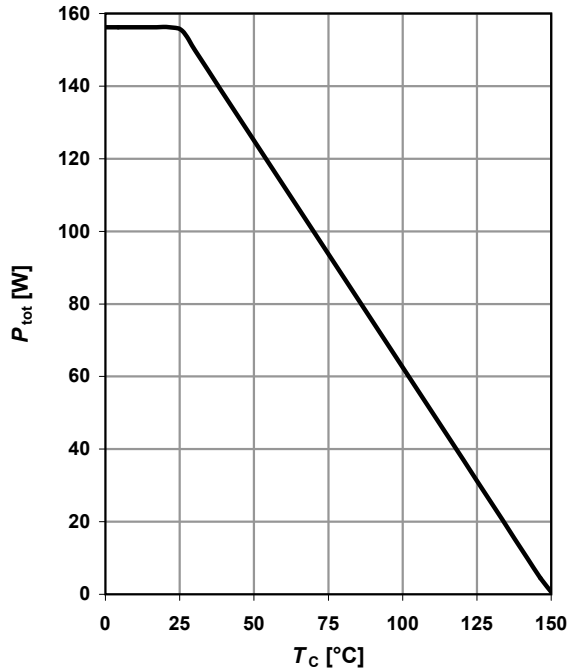
<sup>4)</sup> Repetitive avalanche causes additional power losses that can be calculated as  $P_{AV}=E_{AR} \cdot f$ .

<sup>5)</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 80%  $V_{DSS}$ .

<sup>6)</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 80%  $V_{DSS}$ .

**1 Power dissipation**

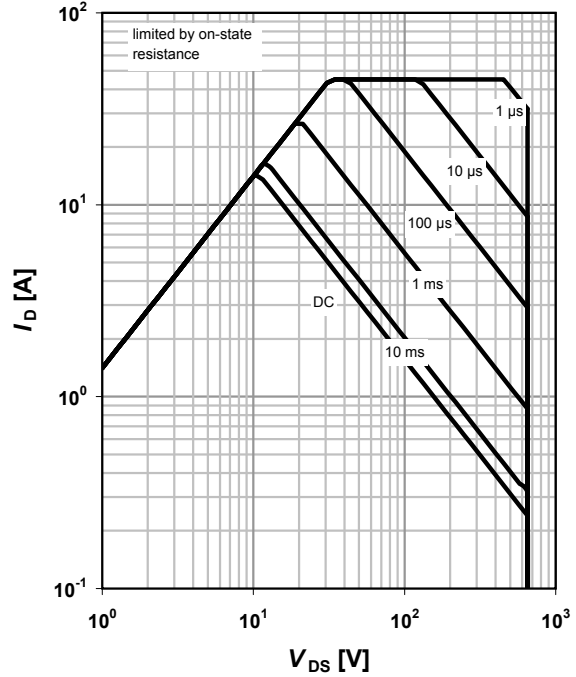
$$P_{tot} = f(T_C)$$



**2 Safe operating area**

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

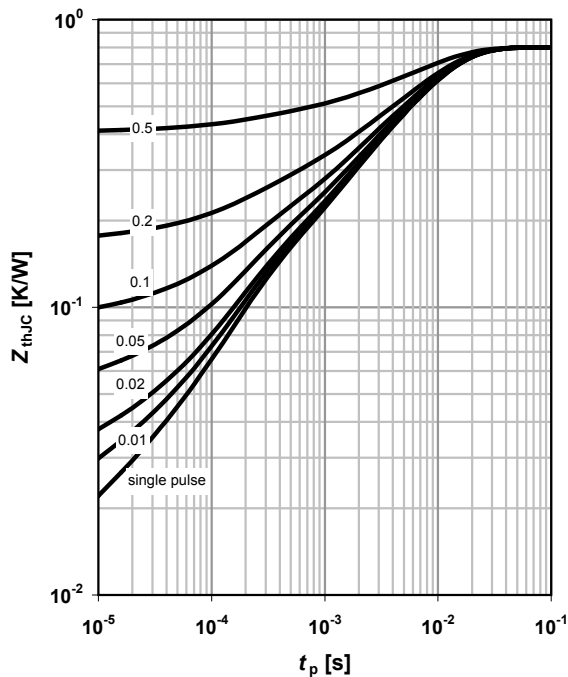
parameter:  $t_p$



**3 Max. transient thermal impedance**

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

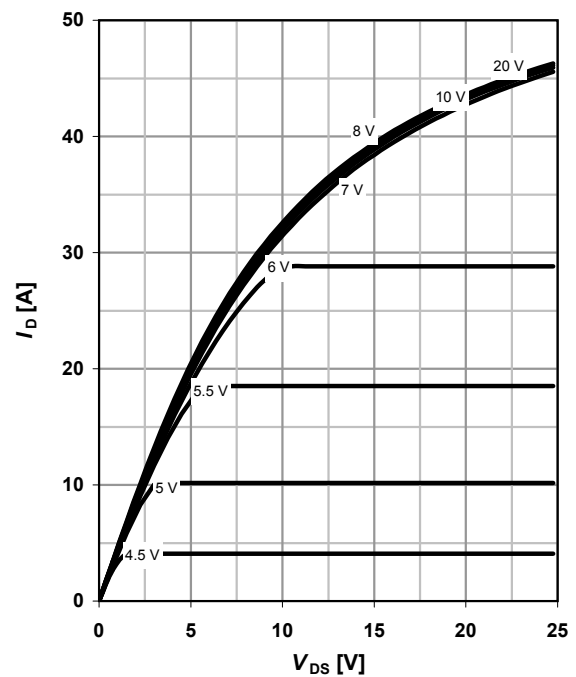
parameter:  $D = t_p / T$



**4 Typ. output characteristics**

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

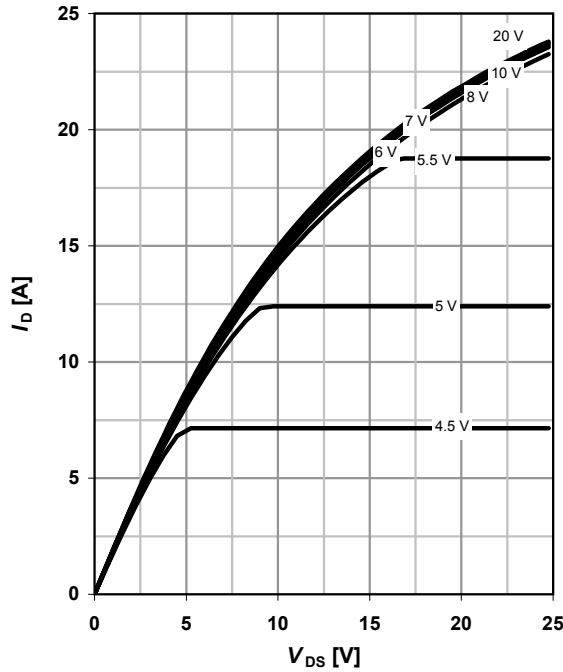
parameter:  $V_{GS}$



**5 Typ. output characteristics**

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

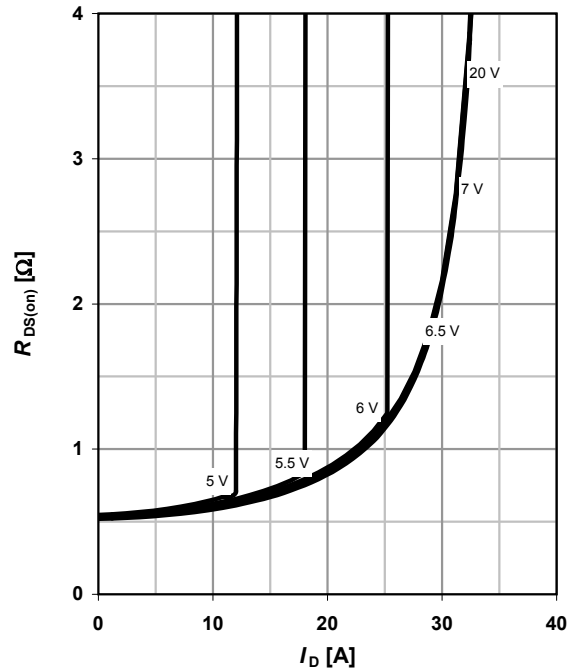
parameter:  $V_{GS}$



**6 Typ. drain-source on-state resistance**

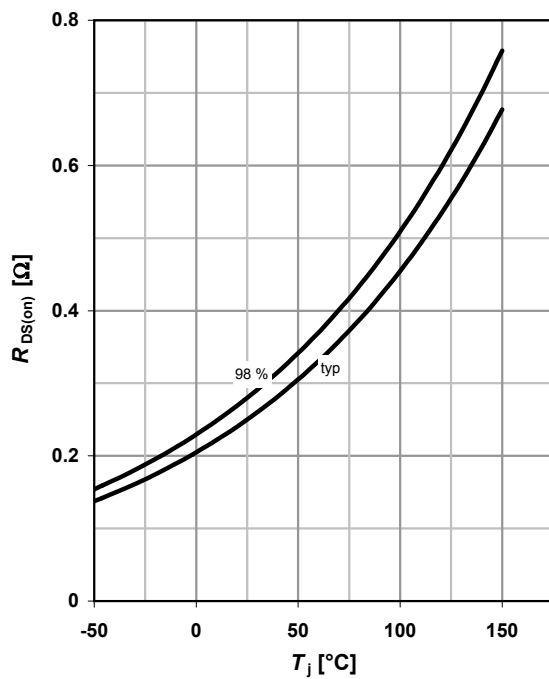
$R_{DS(on)} = f(I_D); T_j = 150\text{ }^\circ\text{C}$

parameter:  $V_{GS}$



**7 Drain-source on-state resistance**

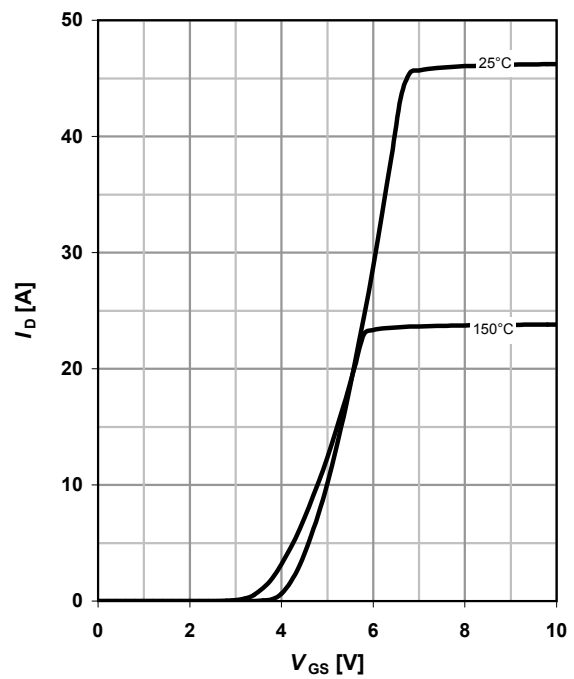
$R_{DS(on)} = f(T_j); I_D = 9.4\text{ A}; V_{GS} = 10\text{ V}$



**8 Typ. transfer characteristics**

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

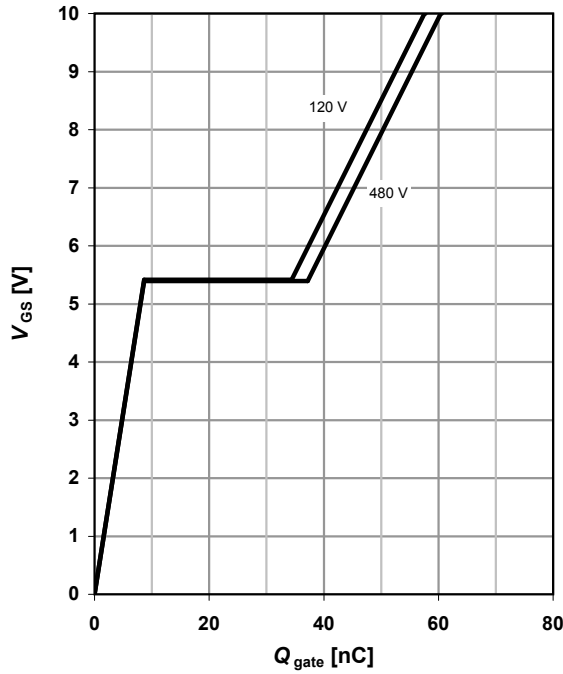
parameter:  $T_j$



**9 Typ. gate charge**

$V_{GS}=f(Q_{gate}); I_D=15\text{ A pulsed}$

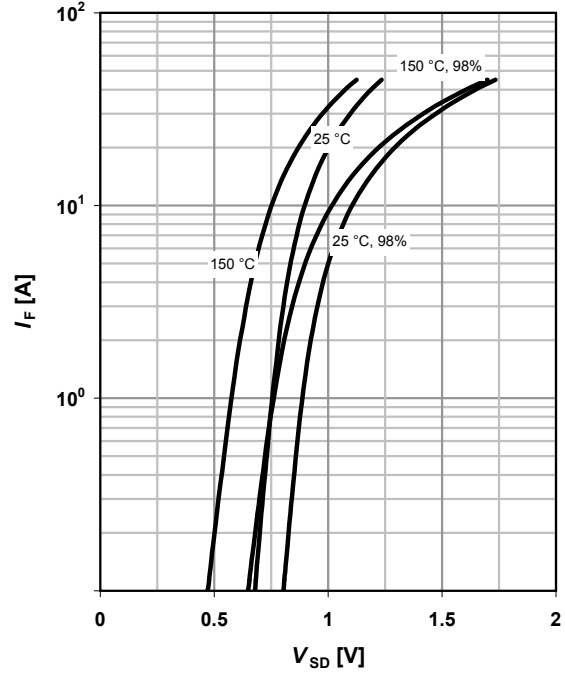
parameter:  $V_{DD}$



**10 Forward characteristics of reverse diode**

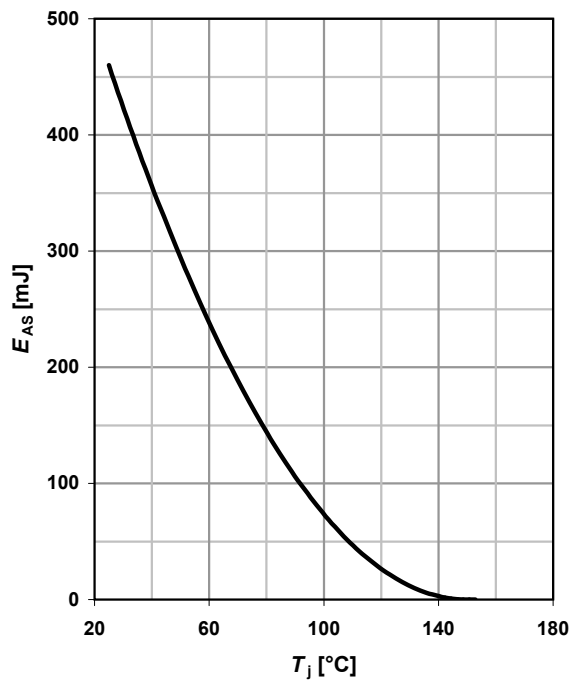
$I_F=f(V_{SD})$

parameter:  $T_j$



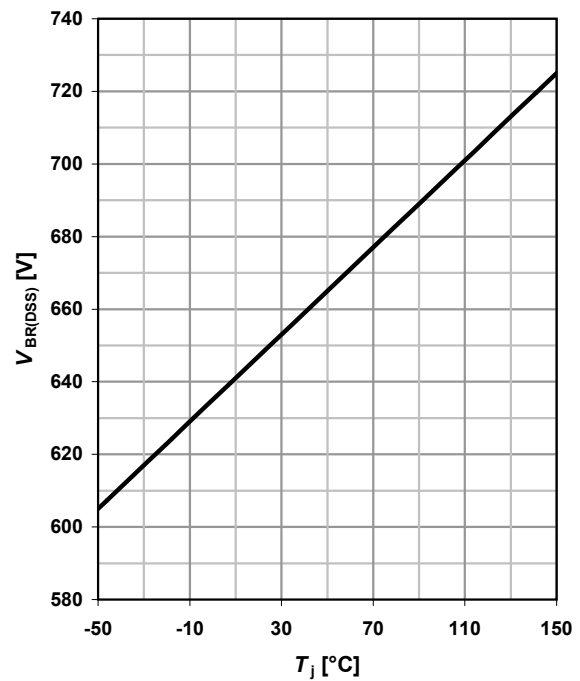
**11 Avalanche energy**

$E_{AS}=f(T_j); I_D=3\text{ A}; V_{DD}=50\text{ V}$



**12 Drain-source breakdown voltage**

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

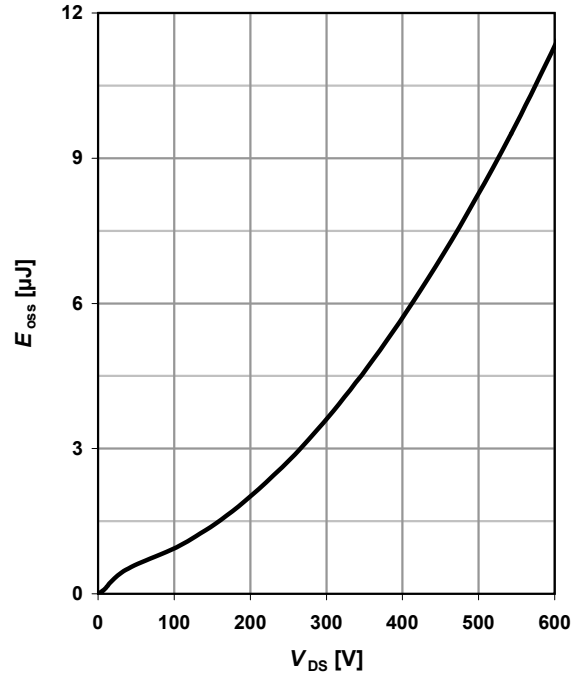
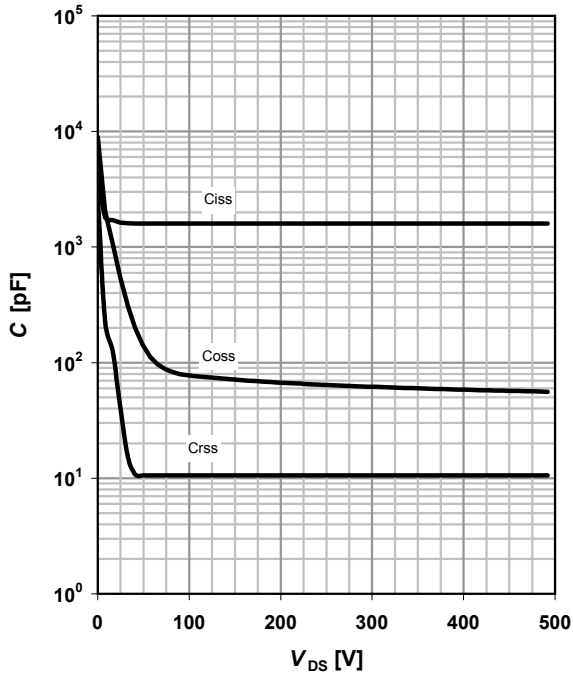


13 Typ. capacitances

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

14 Typ. Coss stored energy

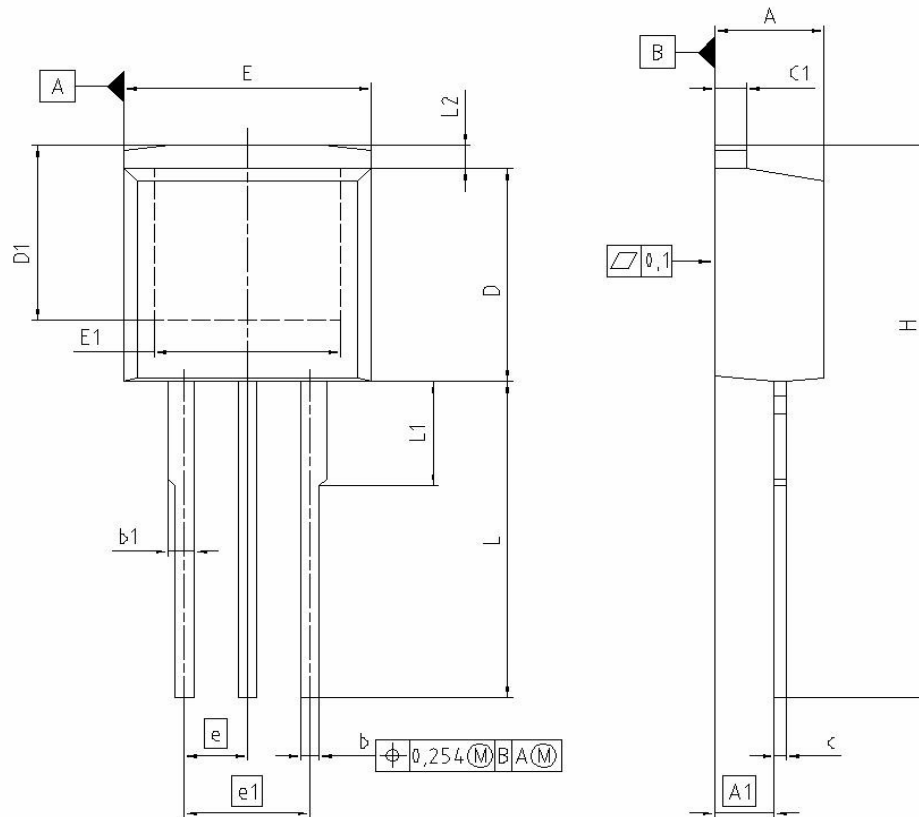
$E_{oss}=f(V_{DS})$



Definition of diode switching characteristics







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

**REFERENCE**  
JEDEC TO262

**SCALE**

**EUROPEAN PROJECTION**

**ISSUE DATE**  
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**FILE**  
TO262\_1

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