

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

- Lowest figure-of-merit  $R_{ON} \times Q_g$
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC<sup>1)</sup> for target applications
- Pb-free lead plating; RoHS compliant; available in Halogen free mold compound<sup>a)</sup>
- Ultra low gate charge

**Product Summary**

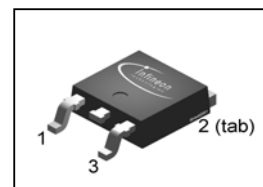
$V_{DS} @ T_J=25^\circ\text{C}$	900	V
$R_{DS(on),max} @ T_J=25^\circ\text{C}$	1.2	$\Omega$
$Q_{g,typ}$	28	nC

**CoolMOS™ 900V is designed for:**

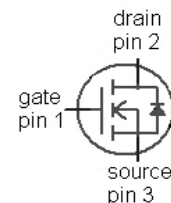
- Quasi Resonant Flyback / Forward topologies
- PC Silverbox and consumer applications
- Industrial SMPS



PG-TO252



Type	Package	Marking
IPD90R1K2C3	PG-TO252	9R1K2C


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25^\circ\text{C}$	5.1	A
		$T_C=100^\circ\text{C}$	3.2	
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	$T_C=25^\circ\text{C}$	10	
Avalanche energy, single pulse	$E_{AS}$	$I_D=0.92\text{ A}, V_{DD}=50\text{ V}$	68	mJ
Avalanche energy, repetitive $t_{AR}$ <sup>2),3)</sup>	$E_{AR}$	$I_D=0.92\text{ A}, V_{DD}=50\text{ V}$	0.31	
Avalanche current, repetitive $t_{AR}$ <sup>2),3)</sup>	$I_{AR}$		0.92	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS}=0\dots400\text{ V}$	50	V/ns
Gate source voltage	$V_{GS}$	static	$\pm 20$	V
		AC ( $f>1\text{ Hz}$ )	$\pm 30$	
Power dissipation	$P_{tot}$	$T_C=25^\circ\text{C}$	83	W
Operating and storage temperature	$T_J, T_{stg}$		-55 ... 150	$^\circ\text{C}$

a) non-Halogen free (OPN: IPD90R1K2C3BT); Halogen free (OPN: IPD90R1K2C3AT)

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

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current	$I_S$	$T_C=25\text{ °C}$	2.8	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$		11	
Reverse diode dv/dt <sup>4)</sup>	$dv/dt$		4	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Thermal characteristics**

Thermal resistance, junction - case	$R_{thJC}$		-	-	1.5	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	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}$ , $I_D=250\text{ }\mu\text{A}$	900	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ , $I_D=0.31\text{ mA}$	2.5	3	3.5	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=900\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=25\text{ °C}$	-	-	1	$\mu\text{A}$
		$V_{DS}=900\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=150\text{ °C}$	-	10	-	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}$ , $I_D=2.8\text{ A}$ , $T_J=25\text{ °C}$	-	0.94	1.2	$\Omega$
		$V_{GS}=10\text{ V}$ , $I_D=2.8\text{ A}$ , $T_J=150\text{ °C}$	-	2.5	-	
Gate resistance	$R_G$	$f=1\text{ MHz}$ , open drain	-	1.3	-	$\Omega$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics**

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=100\text{ V},$ $f=1\text{ MHz}$	-	710	-	pF
Output capacitance	$C_{oss}$		-	35	-	
Effective output capacitance, energy related <sup>5)</sup>	$C_{o(er)}$	$V_{GS}=0\text{ V}, V_{DS}=0\text{ V}$ to 500 V	-	23	-	
Effective output capacitance, time related <sup>6)</sup>	$C_{o(tr)}$		-	86	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=400\text{ V},$ $V_{GS}=10\text{ V}, I_D=2.8\text{ A},$ $R_G=81.3\ \Omega$	-	70	-	ns
Rise time	$t_r$		-	20	-	
Turn-off delay time	$t_{d(off)}$		-	400	-	
Fall time	$t_f$		-	40	-	

**Gate Charge Characteristics**

Gate to source charge	$Q_{gs}$	$V_{DD}=400\text{ V}, I_D=2.8\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	3.2	-	nC
Gate to drain charge	$Q_{gd}$		-	12	-	
Gate charge total	$Q_g$		-	28	tbd	
Gate plateau voltage	$V_{plateau}$		-	4.6	-	V

**Reverse Diode**

Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=2.8\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.8	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=400\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	310	-	ns
Reverse recovery charge	$Q_{rr}$		-	3.7	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	19	-	A

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

<sup>2)</sup> Pulse width  $t_p$  limited by  $T_{J,max}$

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

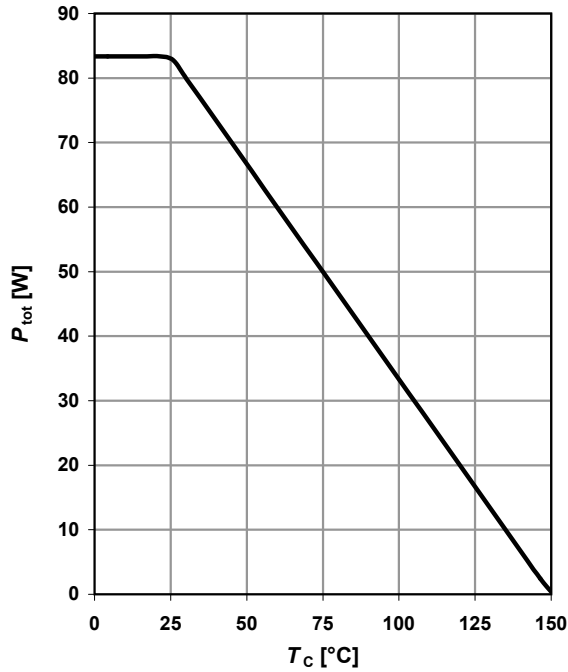
<sup>4)</sup>  $I_{SD} \leq I_D, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DClink}=400\text{ V}, V_{peak} < V_{(BR)DSS}, T_J < T_{J,max}$ , identical low side and high side switch

<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 50%  $V_{DSS}$ .

<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 50%  $V_{DSS}$ .

**1 Power dissipation**

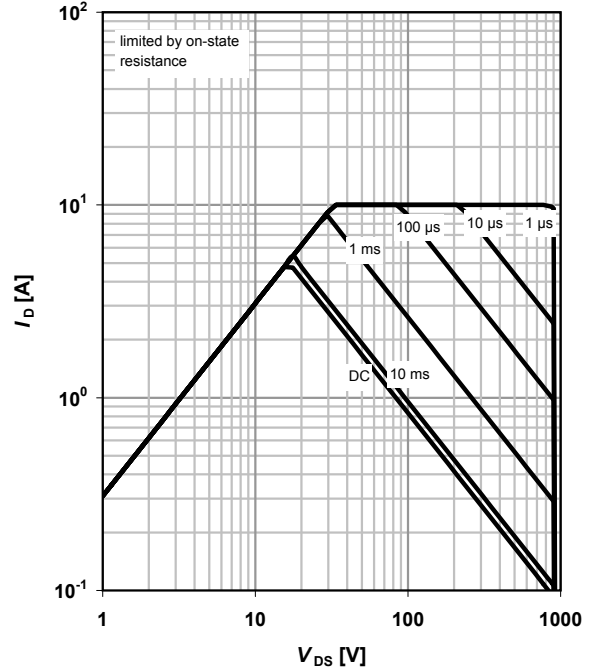
$$P_{tot} = f(T_C)$$



**2 Safe operating area**

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

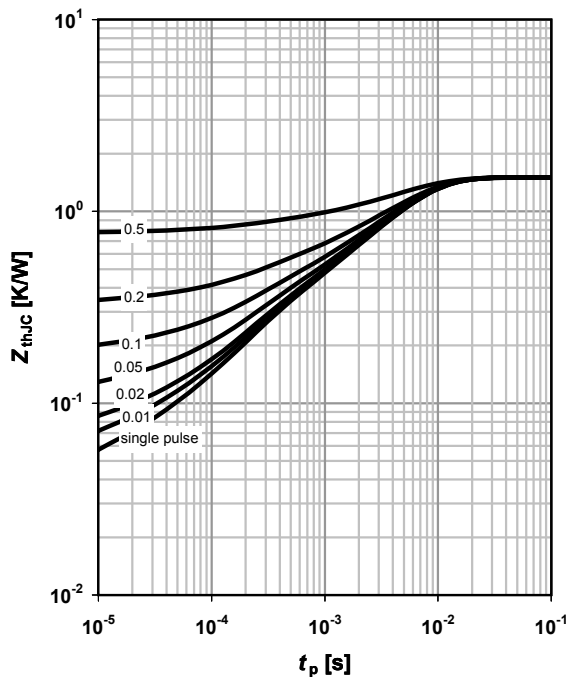
parameter:  $t_p$



**3 Max. transient thermal impedance**

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

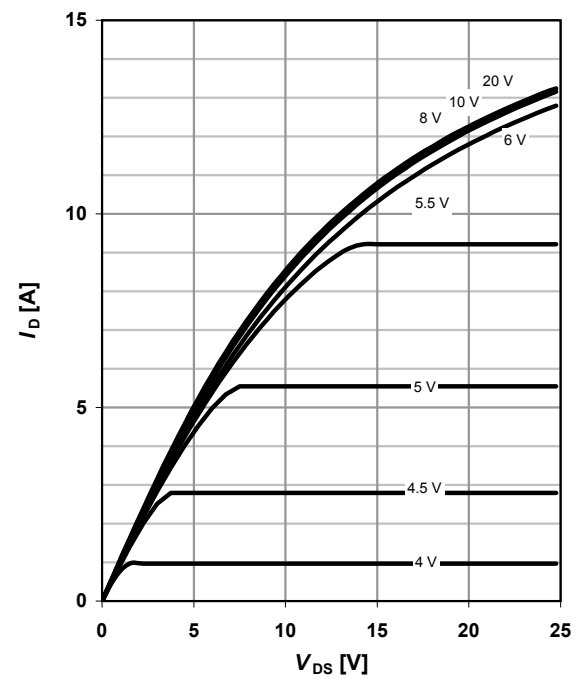
parameter:  $D = t_p / T$



**4 Typ. output characteristics**

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

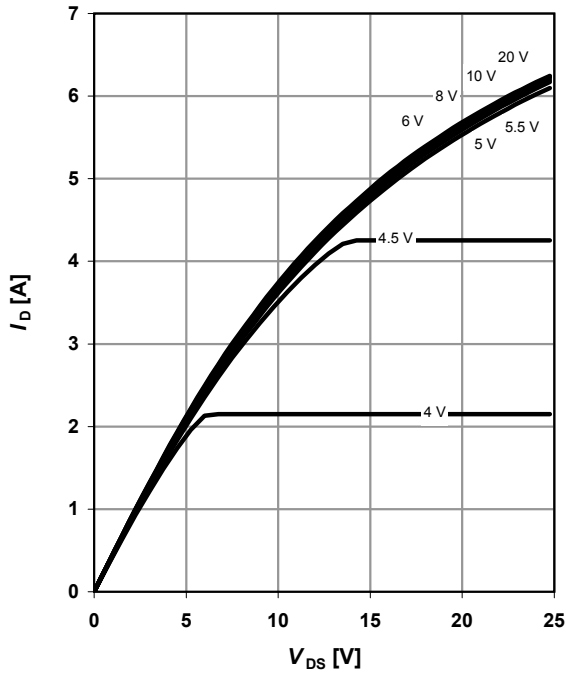
parameter:  $V_{GS}$



**5 Typ. output characteristics**

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

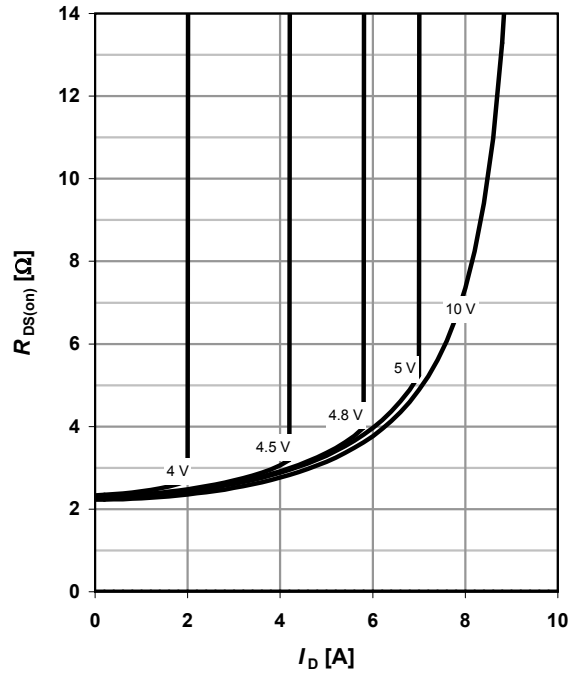
parameter:  $V_{GS}$



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

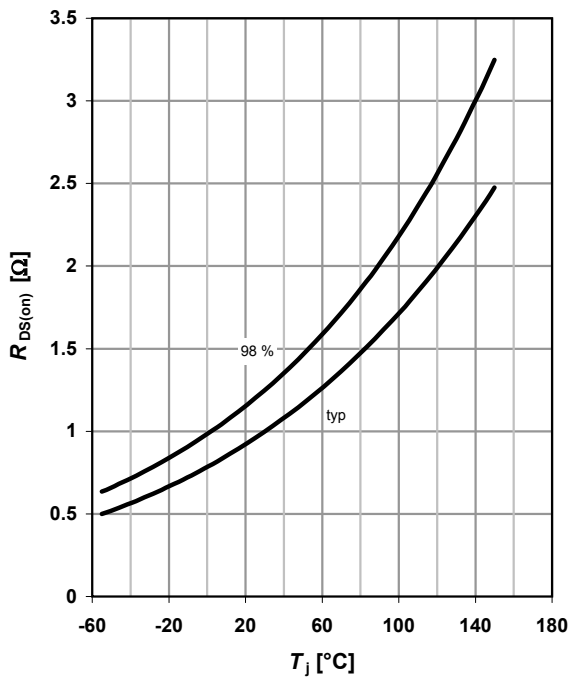
$R_{DS(on)} = f(I_D); T_J = 150\text{ }^\circ\text{C}$

parameter:  $V_{GS}$



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

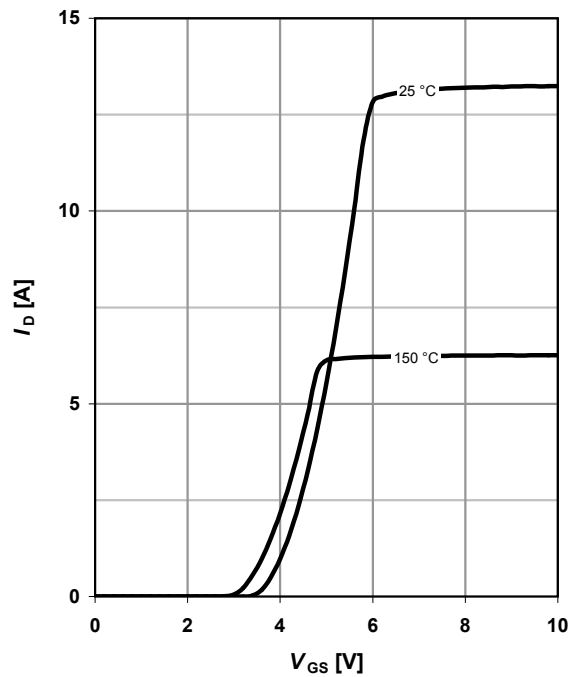
$R_{DS(on)} = f(T_J); I_D = 2.8\text{ A}; V_{GS} = 10\text{ V}$



**8 Typ. transfer characteristics**

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

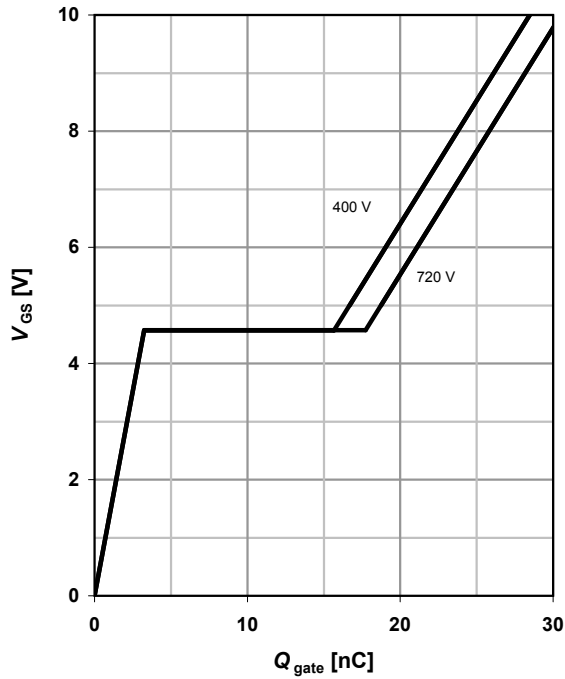
parameter:  $T_J$



**9 Typ. gate charge**

$V_{GS}=f(Q_{gate}); I_D=2.8 \text{ A pulsed}$

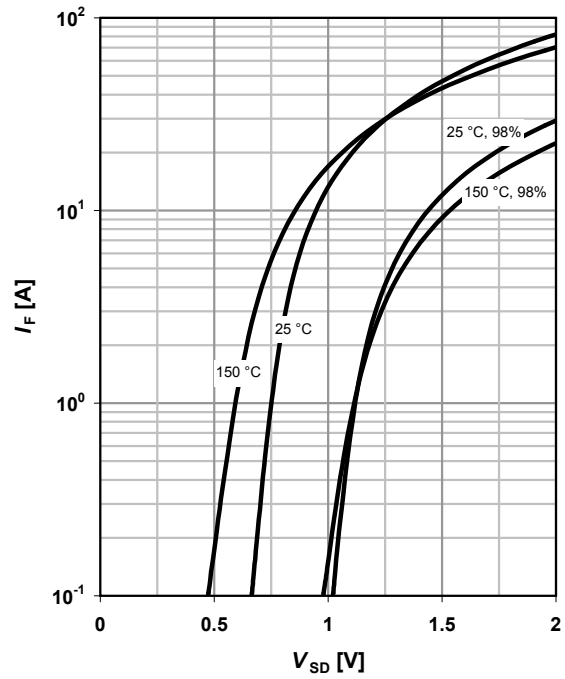
parameter:  $V_{DD}$



**10 Forward characteristics of reverse diode**

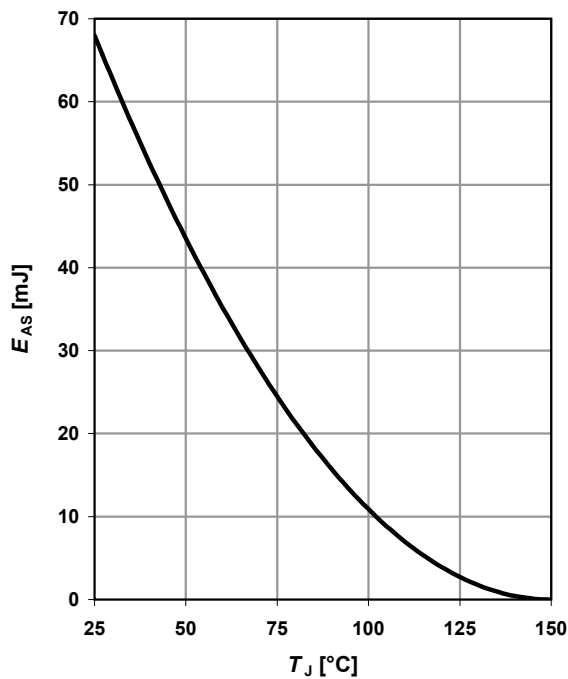
$I_F=f(V_{SD})$

parameter:  $T_J$



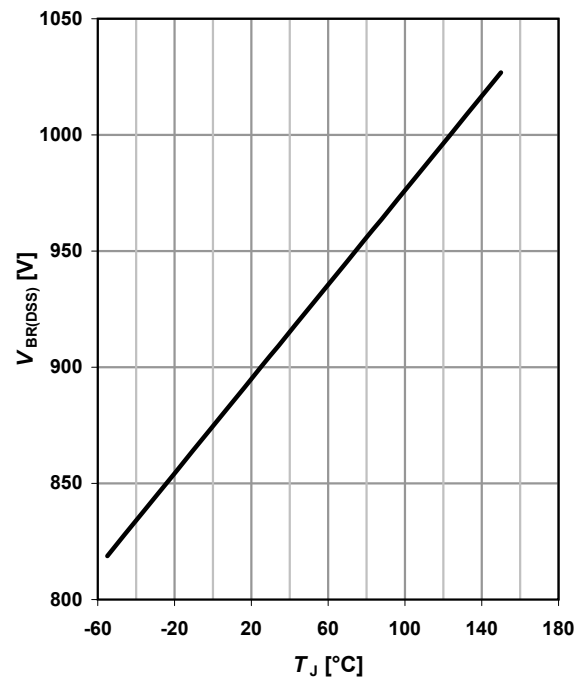
**11 Avalanche energy**

$E_{AS}=f(T_J); I_D=0.92 \text{ A}; V_{DD}=50 \text{ V}$



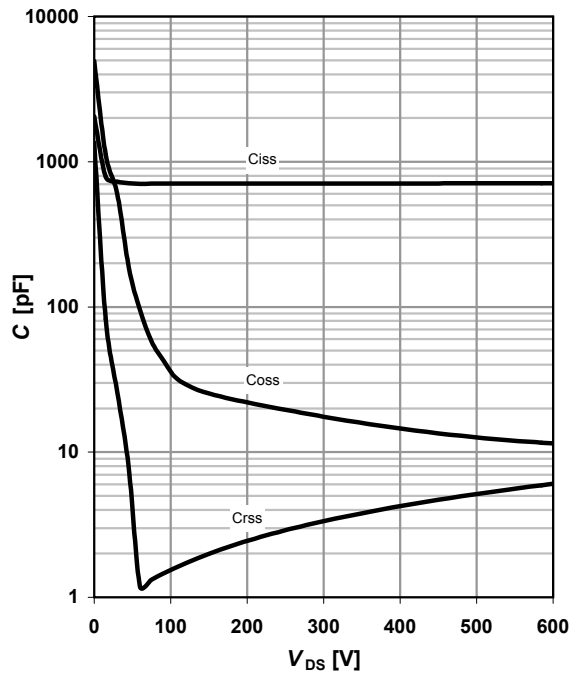
**12 Drain-source breakdown voltage**

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



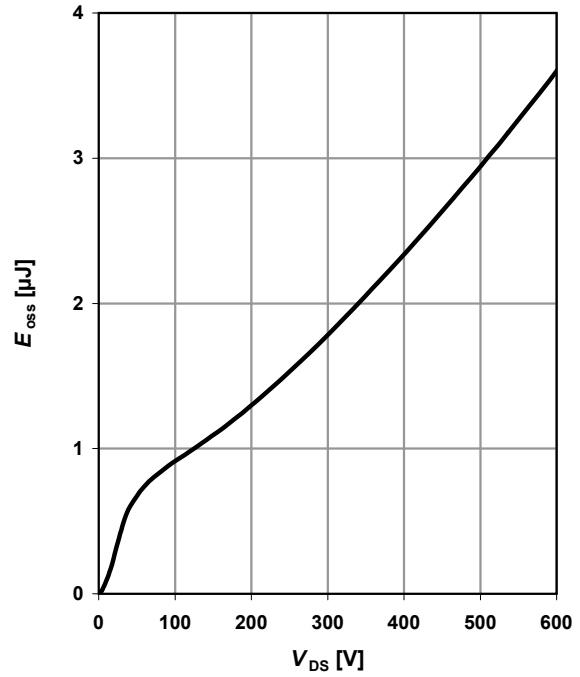
13 Typ. capacitances

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



14 Typ. C<sub>oss</sub> stored energy

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

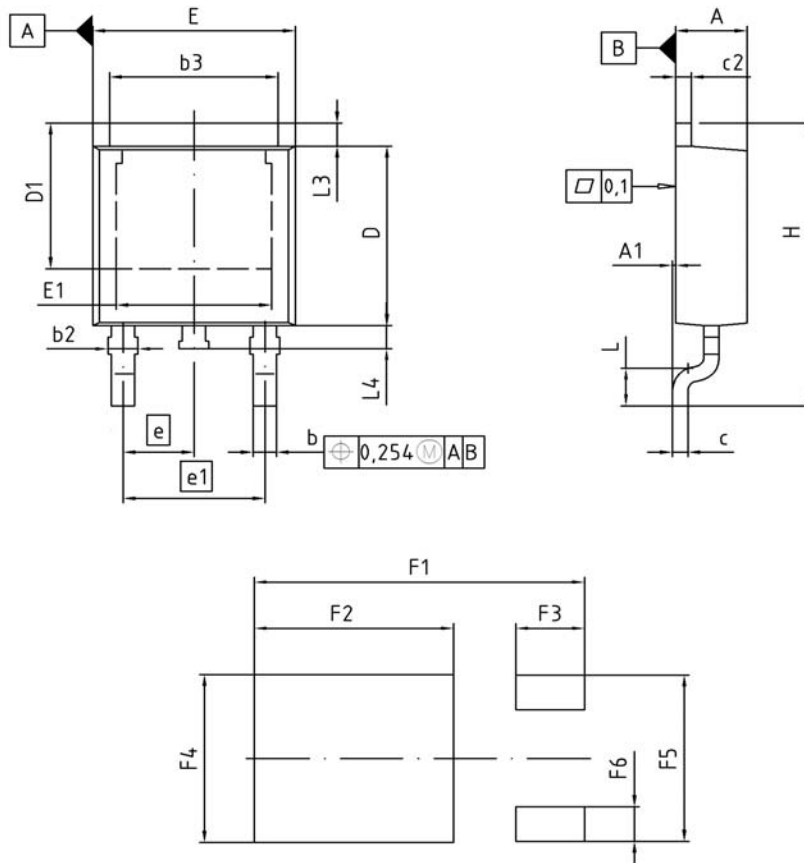


Definition of diode switching characteristics





PG-TO252 Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.16	2.41	0.085	0.095
A1	0.00	0.15	0.000	0.006
b	0.64	0.89	0.025	0.035
b2	0.65	1.15	0.026	0.045
b3	5.00	5.50	0.197	0.217
c	0.46	0.60	0.018	0.024
c2	0.46	0.98	0.018	0.039
D	5.97	6.22	0.235	0.245
D1	5.02	5.84	0.198	0.230
E	6.40	6.73	0.252	0.265
E1	4.70	5.21	0.185	0.205
e	2.29		0.090	
e1	4.57		0.180	
N	3		3	
H	9.40	10.48	0.370	0.413
L	1.18	1.70	0.046	0.067
L3	0.90	1.25	0.035	0.049
L4	0.51	1.00	0.020	0.039
F1	10.50	10.70	0.413	0.421
F2	6.30	6.50	0.248	0.256
F3	2.10	2.30	0.083	0.091
F4	5.70	5.90	0.224	0.232
F5	5.66	5.86	0.223	0.231
F6	1.10	1.30	0.043	0.051

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SCALE

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