CoolMOS™ CP 600V

600V CoolMOS™ CP Power Transistor
IPD60R385CP

Data Sheet

Rev. 2.6
Final

Power Management & Multimarket

CoolMOS® Power Transistor

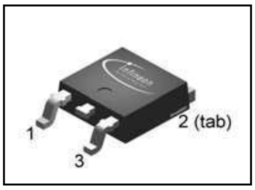
Features

- Worldwide best $R_{ds,on}$ in TO252
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Fully qualified according to JEDEC for industrial applications
- Pb-free lead plating; RoHS compliant, available in Halogen free mold compound

Product Summary

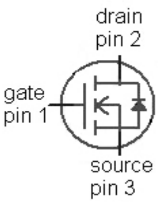
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.385	Ω
$Q_{g,typ}$	17	nC

PG-TO252



CoolMOS CP is specially designed for:

- Hard switching SMPS topologies



Type	Package	Ordering Code	Marking
IPD60R385CP	PG-TO252	SP000307381	6R385P

Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	9.0	A
		T_C=100 °C	5.7	
Pulsed drain current[2)]	$I_{D,pulse}$	T_C=25 °C	27	
Avalanche energy, single pulse	E_{AS}	I_D=3.4 A, V_{DD}=50 V	227	mJ
Avalanche energy, repetitive t_{AR}[2),3)]	E_{AR}	I_D=3.4 A, V_{DD}=50 V	0.3	
Avalanche current, repetitive t_{AR}[2),3)]	I_{AR}		3	A
MOSFET dv/dt ruggedness	dv/dt	V_{DS}=0...480 V	50	V/ns
Gate source voltage	V_{GS}	static	±20	V
		AC (f>1 Hz)	±30	
Power dissipation	P_{tot}	T_C=25 °C	83	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C

Maximum ratings, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current	I_S	T_C=25 °C	5.2	A
Diode pulse current[2)]	$I_{S,pulse}$		27	
Reverse diode dv/dt[4)]	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values min.	Values typ.	Values max.	Unit
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	1.5	K/W
Thermal resistance, junction - ambient	R_{thJA}	SMD version, device on PCB, minimal footprint	-	-	62	
		SMD version, device on PCB, 6 cm^2 cooling area[5)]	-	35	-	
Soldering temperature, reflowsoldering	T_{sold}	reflow MSL1	-	-	260	°C

Electrical characteristics, at T_j=25 °C, unless otherwise specified

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0 V, I_D=250 µA	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=0.34 mA	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600 V, V_{GS}=0 V, T_j=25 °C	-	-	1	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	10	-	
Gate-source leakage current	I_{GSS}	V_{GS}=20 V, V_{DS}=0 V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=5.2 A, T_j=25 °C	-	0.35	0.385	Ω
		V_{GS}=10 V, I_D=5.2 A, T_j=150 °C	-	0.94	-	
Gate resistance	R_G	f=1 MHz, open drain	-	1.8	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic characteristics						
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz	-	790	-	pF
Output capacitance	C_{oss}		-	38	-	
Effective output capacitance, energy related[6]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	36	-	
Effective output capacitance, time related[7]	$C_{o(tr)}$		-	96	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=5.2 A, R_G=3.3 Ω	-	10	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	40	-	
Fall time	t_f		-	5	-	

0

Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=5.2 A, V_{GS}=0 to 10 V	-	4	-	nC
Gate charge at threshold	$Q_{g(th)}$		-	4.6	6.2	
Gate to drain charge	Q_{gd}		-	6	-	
Switching charge	Q_{sw}		-	12	17	
Gate charge total	Q_g		-	17	22	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=5.2 A, T_j=25 °C	-	0.9	1.2	V
Reverse recovery time	t_{rr}	V_R=400 V, I_F=I_S, di_F/dt=100 A/µs	-	260	-	ns
Reverse recovery charge	Q_{rr}		-	3.1	-	µC
Peak reverse recovery current	I_{rrm}		-	24	-	A

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

[3] Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

[4] $I_{SD} \leq I_D$, di/dt≤400A/µs, V_{DClink}=400V, $V_{peak}<V_{(BR)DSS}$, $T_j<T_{jmax}$, identical low side and high side switch

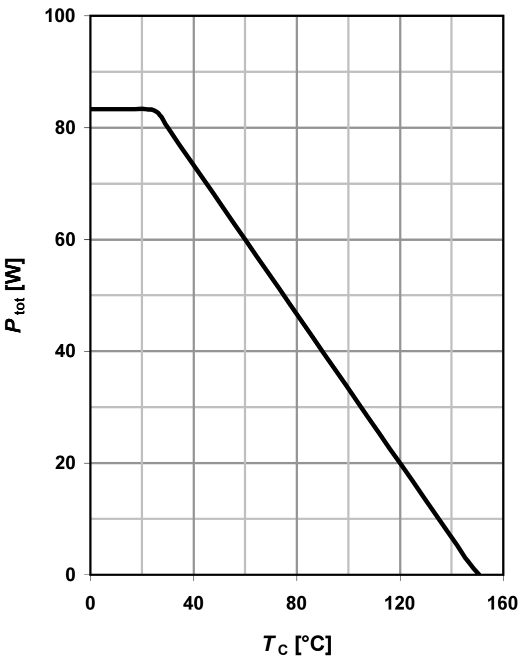
[5] Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm2 (one layer, 70µm thick) copper area for drain connection. PCB is without blown air.

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

[7] $C_{o(tr)}$ 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

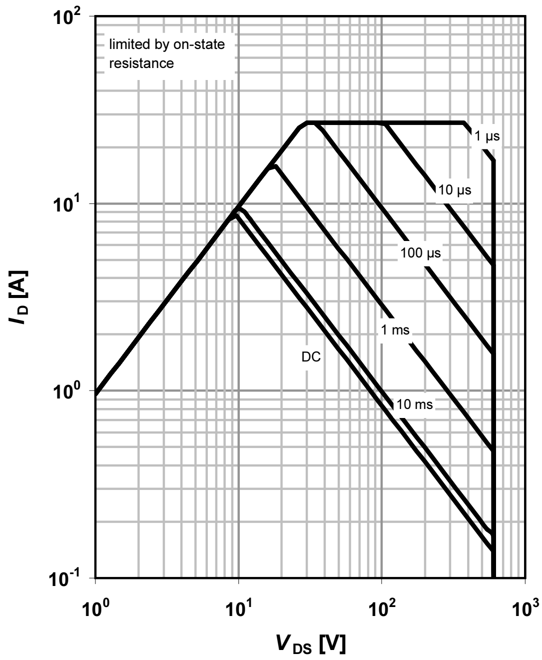
P_{tot}=f(T_C)



2 Safe operating area

I_D=f(V_{DS}); T_C=25 °C; D=0

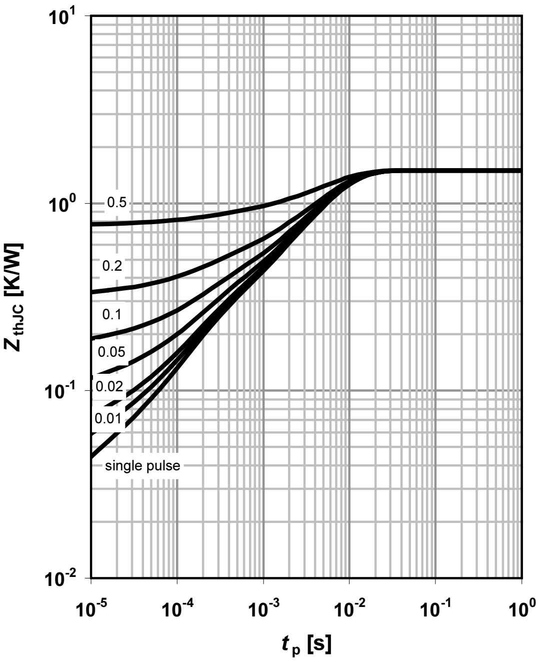
parameter: t_p



3 Max. transient thermal impedance

Z_{thJC}=f(t_P)

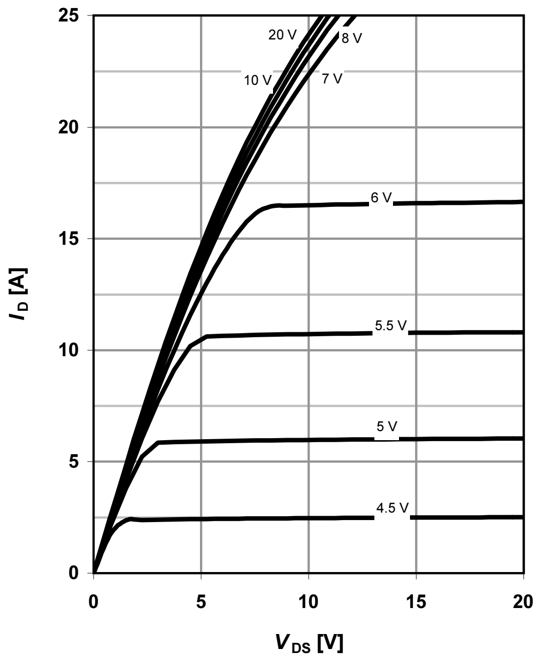
parameter: D=t_p/T



4 Typ. output characteristics

I_D=f(V_{DS}); T_j=25 °C

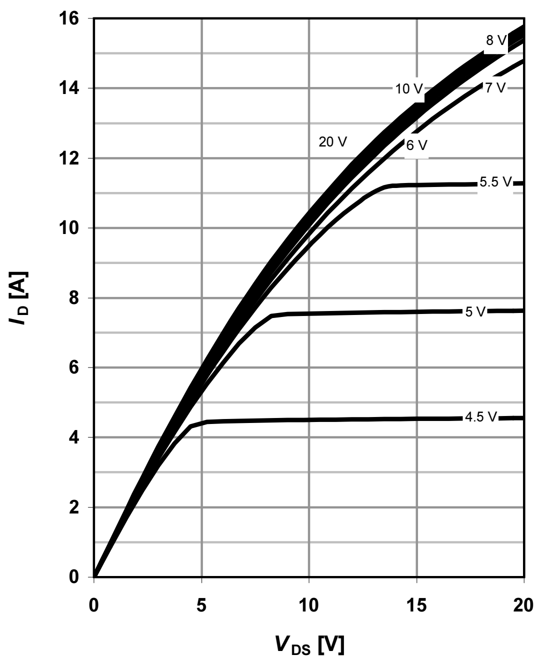
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

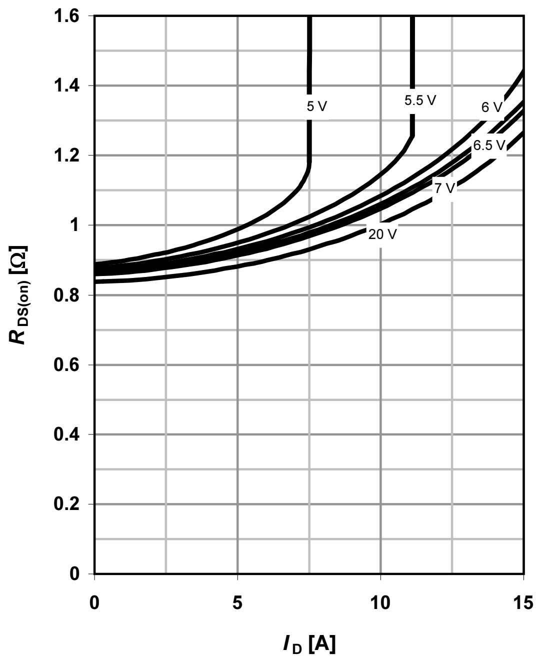
parameter: V_{GS}



6 Typ. drain-source on-state resistance

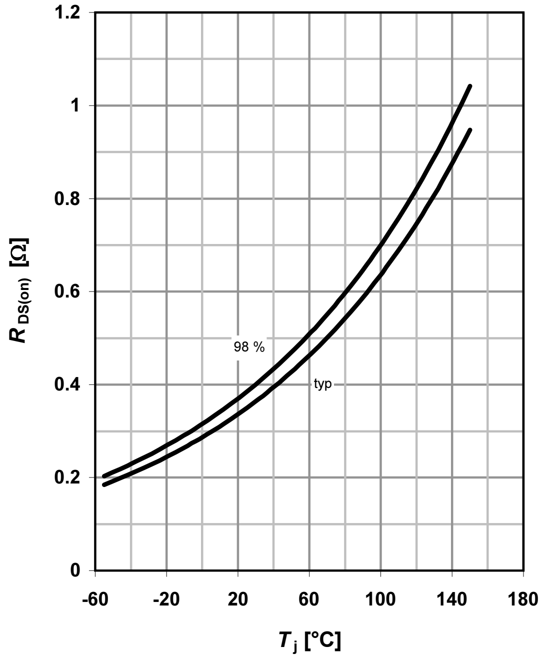
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

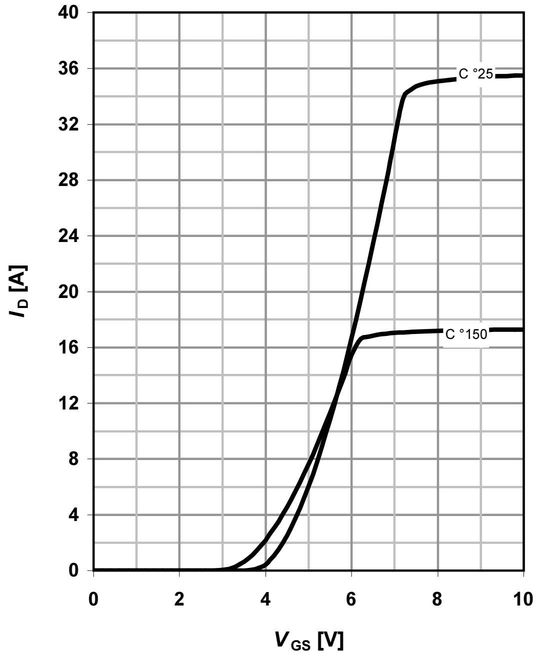
$R_{DS(on)}$=f(T_j); I_D=5.2 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

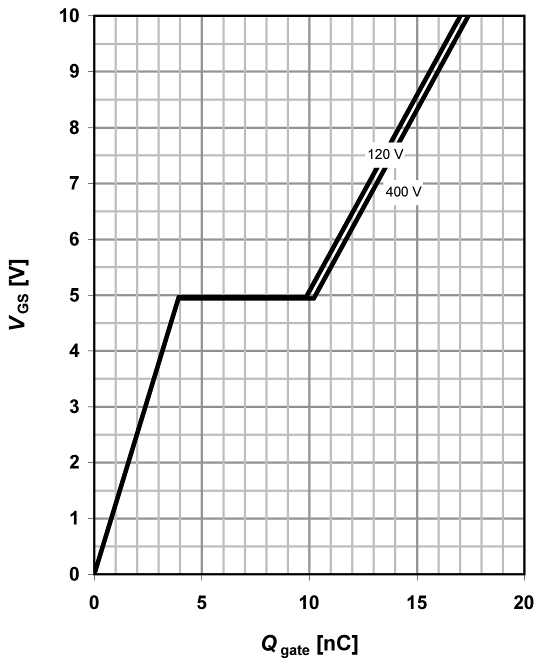
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=5.2 A pulsed

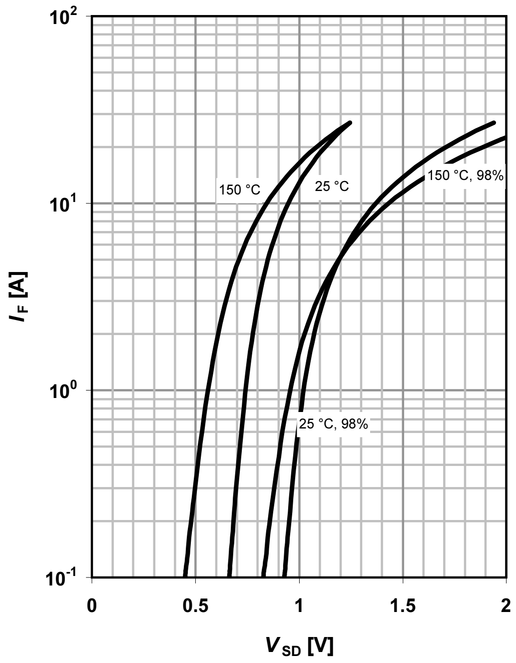
parameter: V_{DD}



10 Forward characteristics of reverse diode

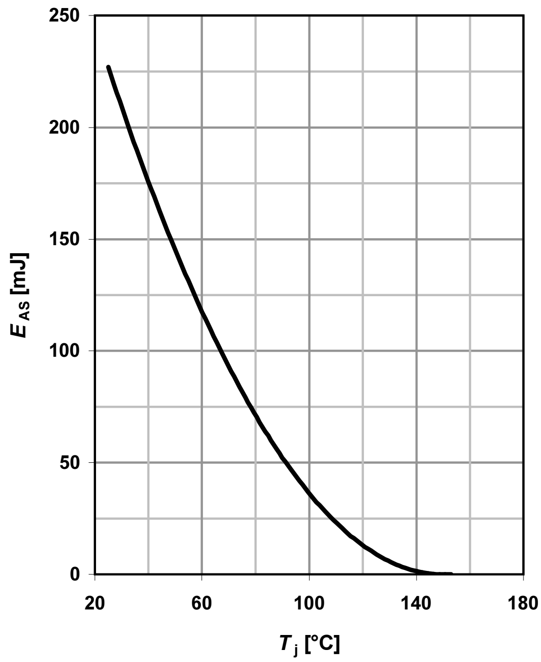
I_F=f(V_{SD})

parameter: T_j



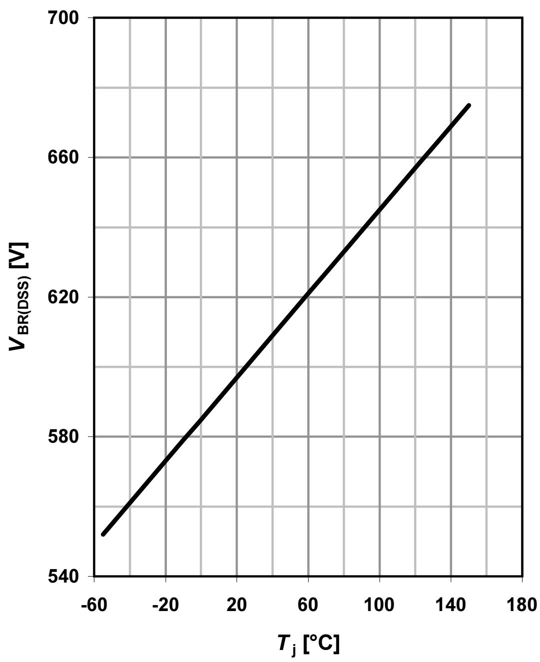
11 Avalanche energy

E_{AS}=f(T_j); I_D=3.4 A; V_{DD}=50 V



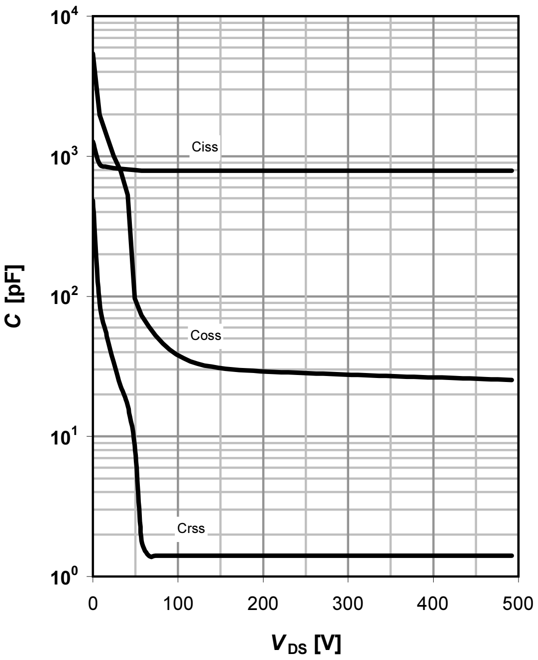
12 Drain-source breakdown voltage

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



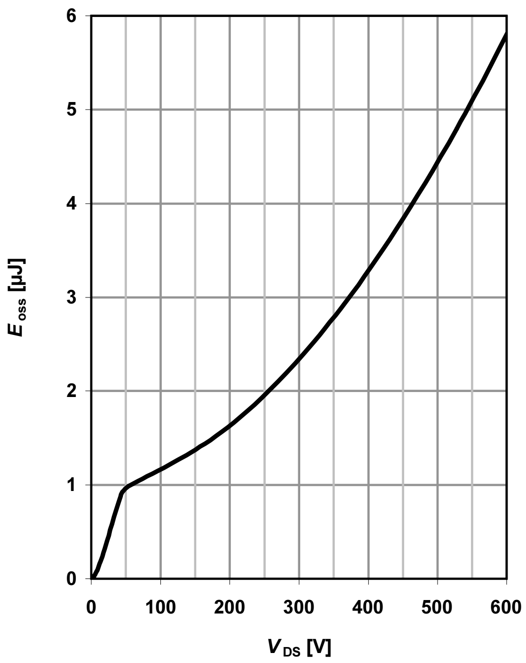
13 Typ. capacitances

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

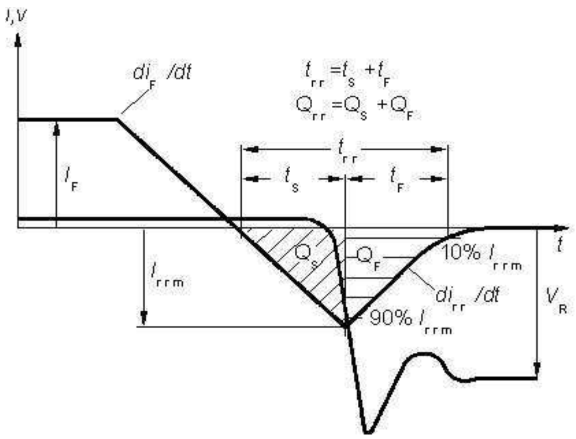


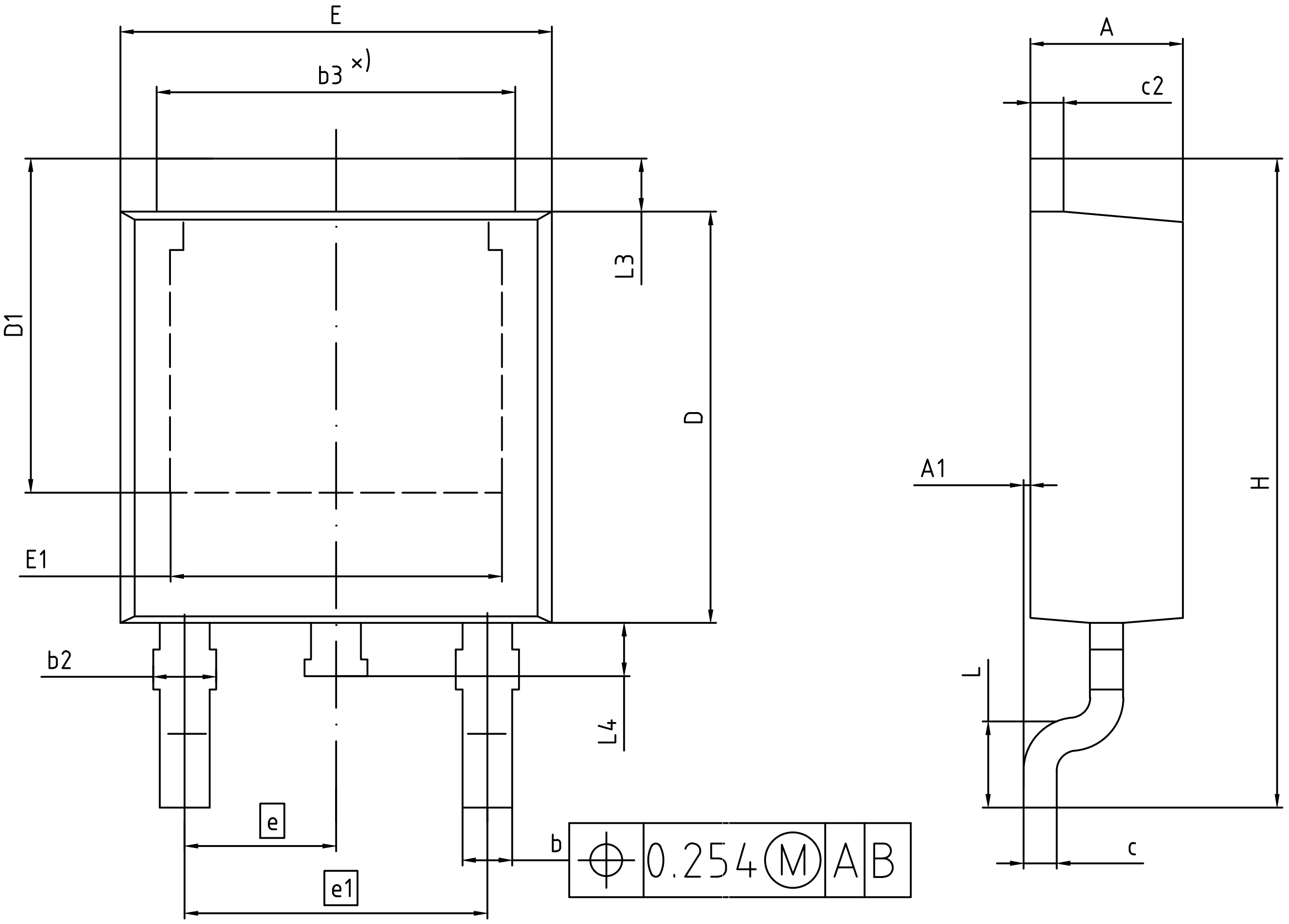
14 Typ. Coss stored energy

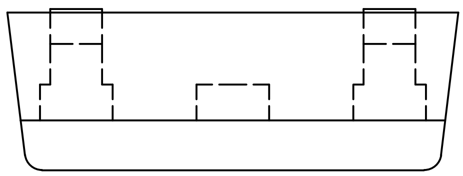
E_{oss}= f(V_{DS})



Definition of diode switching characteristics







ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

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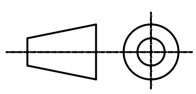
REVISION 07
SCALE: 10:1 0 1 2mm
EUROPEAN PROJECTION
ISSUE DATE 01.04.2020



DIMENSION	MILLIMETERS	
	MIN.	MAX.
A	2.16	2.41
A1	0.00	0.15
b	0.64	0.89
b2	0.65	1.15
b3	4,95	5.50
c	0.46	0.61
c2	0.40	0.98
D	5.97	6.22
D1	5.02	5.84
E	6.35	6.73
E1	4.32	5.50
e	2.29	
e1	4.57	
N	3	
H	9.40	10.48
L	1.18	1.78
L3	0.89	1.27
L4	0.51	1.02

Revision History

IPD60R385CP		
Revision: 2020-05-27, Rev. 2.6		
Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.4	2015-02-03	Update soldering temperature from reflow MSL3 to MSL1
2.5	2016-06-02	Non-halogen free version discontinued (creation: 2016.06.01)
2.6	2020-05-27	Update package outline

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