CoolMOS™ Power Transistor

Features

• Lowest figure-of-merit $R_{ON}xQ_g$

• Ultra low gate charge

• Extreme dv/dt rated

• High peak current capability

• Qualified according to JEDEC[1] for target applications
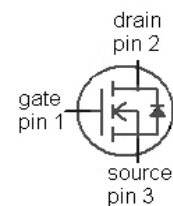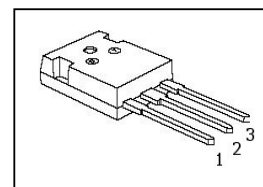
• Pb-free lead plating; RoHS compliant

CoolMOS CP is specially designed for:

Hard switching SMPS topologies

Product Summary

V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.299	Ω
$Q_{g,typ}$	22	nC

PG-TO247-3-1

Type	Package	Ordering Code	Marking
IPW60R299CP	PG-TO247-3-1	SP000103251	6R299P

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	T_C=25 °C	11	A
		T_C=100 °C	7	
Pulsed drain current[2]	$I_{D,pulse}$	T_C=25 °C	34	
Avalanche energy, single pulse	E_{AS}	I_D=4.4 A, V_{DD}=50 V	290	mJ
Avalanche energy, repetitive t_{AR}[2),3)]	E_{AR}	I_D=4.4 A, V_{DD}=50 V	0.44	
Avalanche current, repetitive t_{AR}[2),3)]	I_{AR}		4.4	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	96	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M3 and M3.5 screws	60	Ncm

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	6.6	A
Diode pulse current[2]	$I_{S,pulse}$		34	
Reverse diode dv/dt[4]	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	-	1.3	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 °C, unless otherwise specified

Static characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
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=0,44 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=6.6 A, T_j=25 °C	-	0.27	0.299	Ω
		V_{GS}=10 V, I_D=6.6 A, T_j=150 °C	-	0.73		
Gate resistance	R_G	f=1 MHz, open drain	-	1.9	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Input capacitance	C_{iss}	V_{GS}=0 V, V_{DS}=100 V, f=1 MHz	-	1100	-	pF
Output capacitance	C_{oss}		-	60	-	
Effective output capacitance, energy related[5]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	46	-	
Effective output capacitance, time related[6]	$C_{o(tr)}$		-	120	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=6,6 A, R_G=4,3 Ω	-	10	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	40	-	
Fall time	t_f		-	5	-	

Gate Charge Characteristics

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=6.6 A, V_{GS}=0 to 10 V	-	5	-	nC
Gate to drain charge	Q_{gd}		-	7.6	-	
Gate charge total	Q_g		-	22	29	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V

Reverse Diode

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=6.6 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	-	300	-	ns
Reverse recovery charge	Q_{rr}		-	3.9	-	µC
Peak reverse recovery current	I_{rrm}		-	26	-	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 $P_{AV}=E_{AR}*f$.
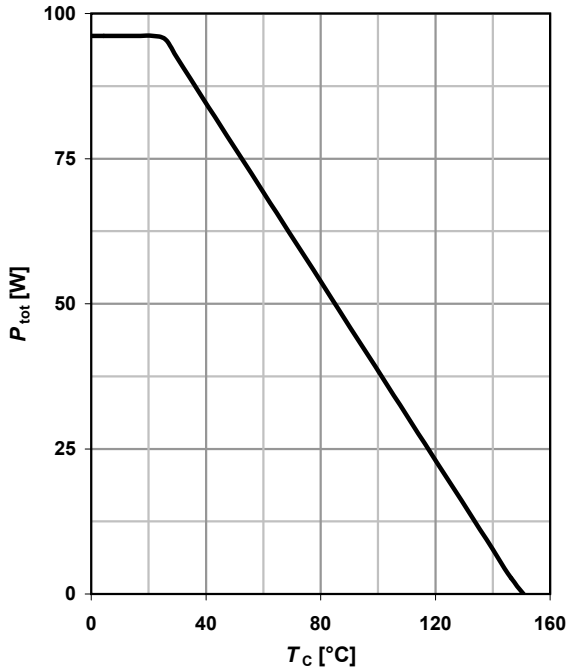
[4] I_{SD}<=I_D, di/dt<=200A/µs, V_{DClink}=400V, V_{peak}<$V_{(BR)DSS}$, T_j<T_{jmax}, identical low side and high side switch.

[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}.
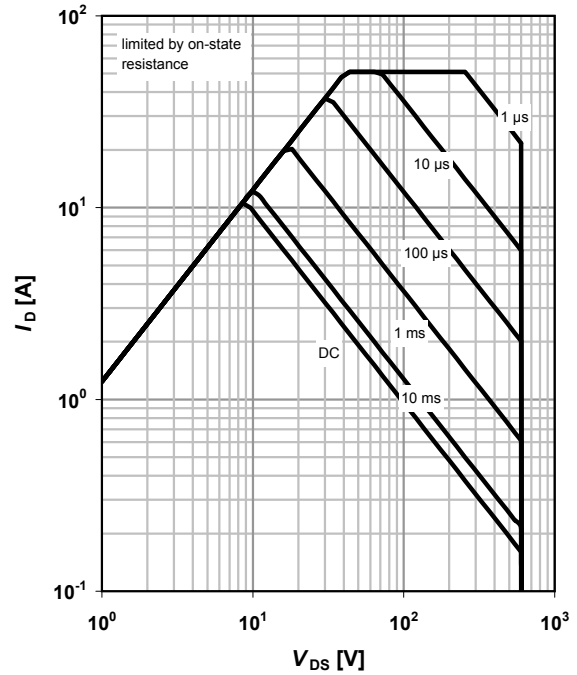
1 Power dissipation

P_{tot}=f(T_C)

2 Safe operating area
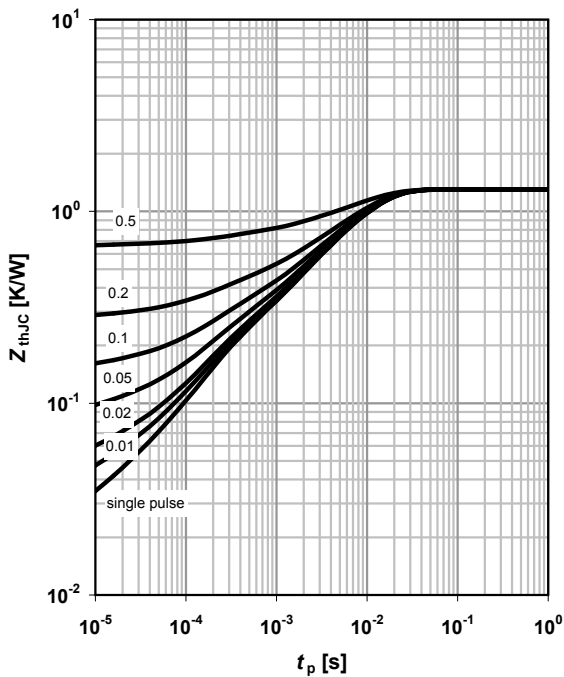
I_D=f(V_{DS}); T_C=25 °C; D =0

parameter: t_p

3 Max. transient thermal impedance
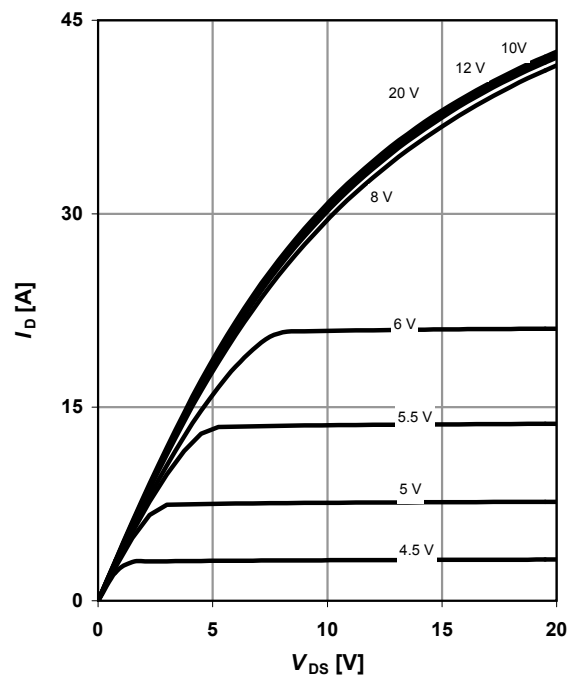
Z_{thJC}=f(t_P)

parameter: D=t_p/T
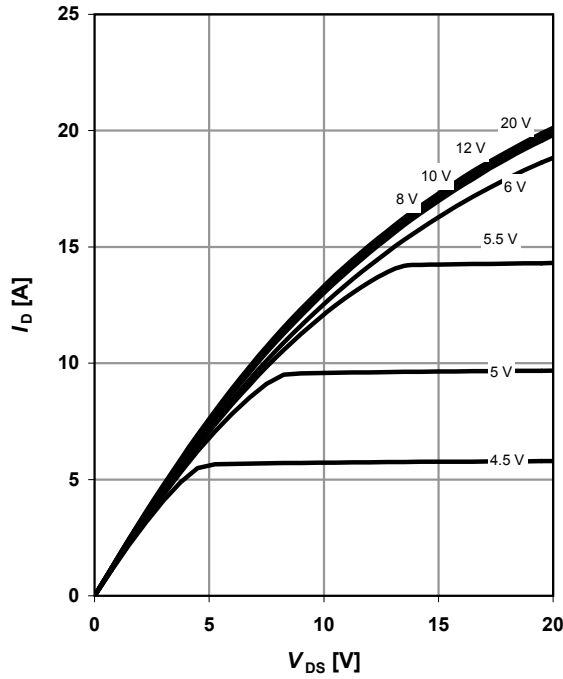

4 Typ. output characteristics

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

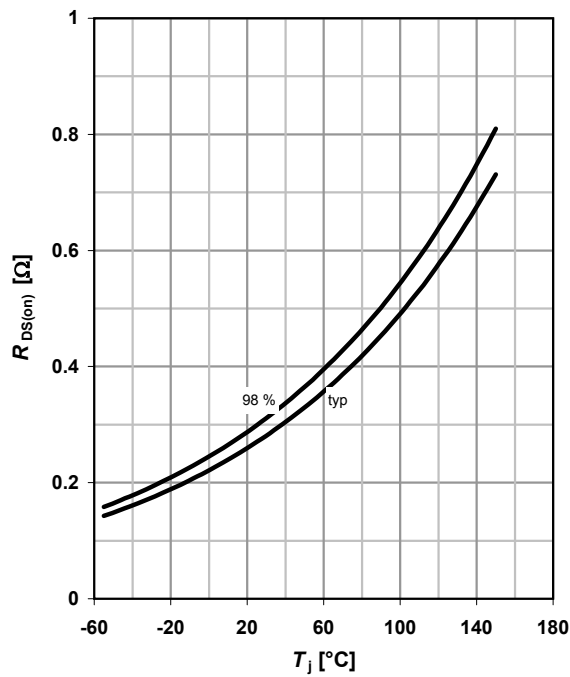parameter: V_{GS}

6 Typ. drain-source on-state resistance

$R_{DS(on)}$=f(I_D); T_j=150 °C

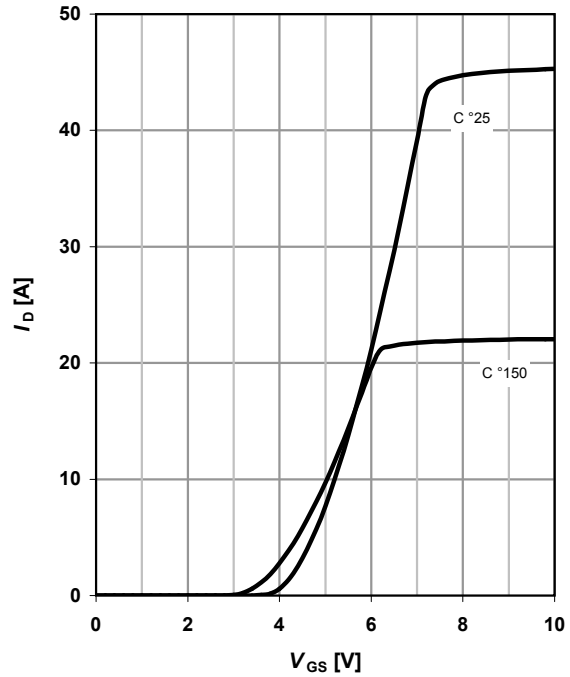parameter: V_{GS}
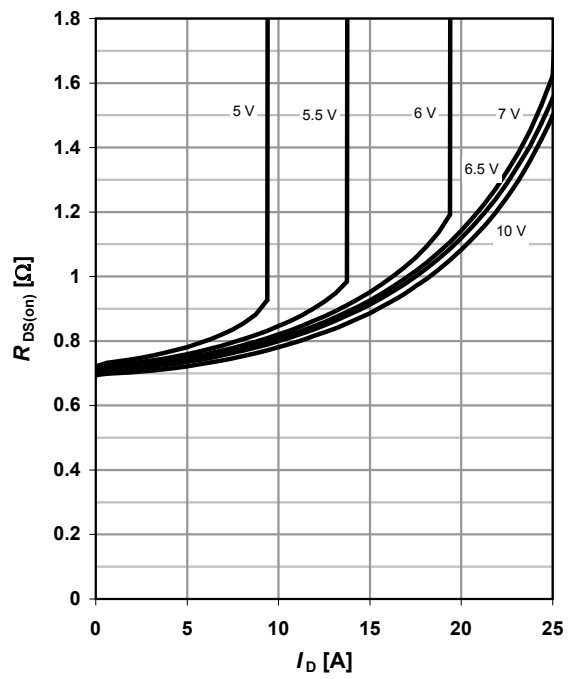
7 Drain-source on-state resistance

$R_{DS(on)}$=f(T_j); I_D=6.6 A; V_{GS}=10 V

8 Typ. transfer characteristics

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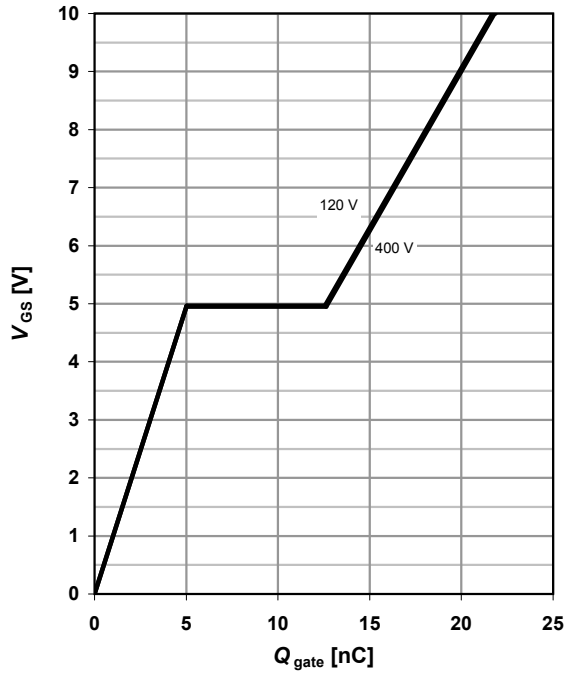
parameter: T_j

9 Typ. gate charge

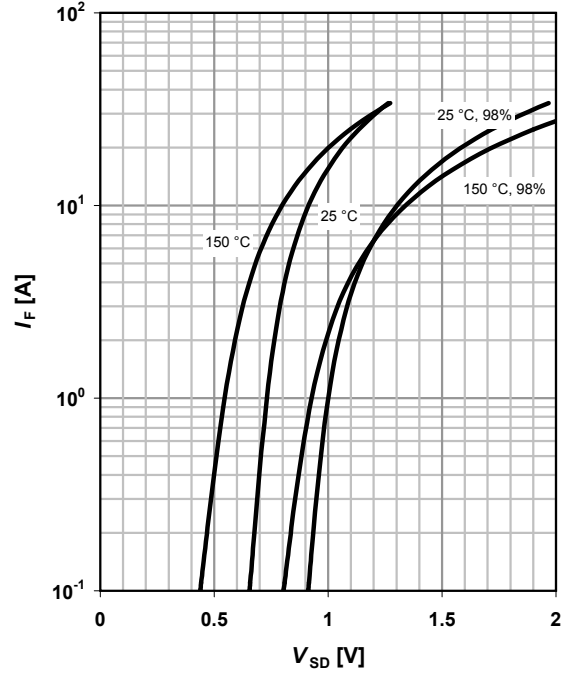V_{GS}=f(Q_{gate}); I_D=6.6 A pulsed

parameter: V_{DD}
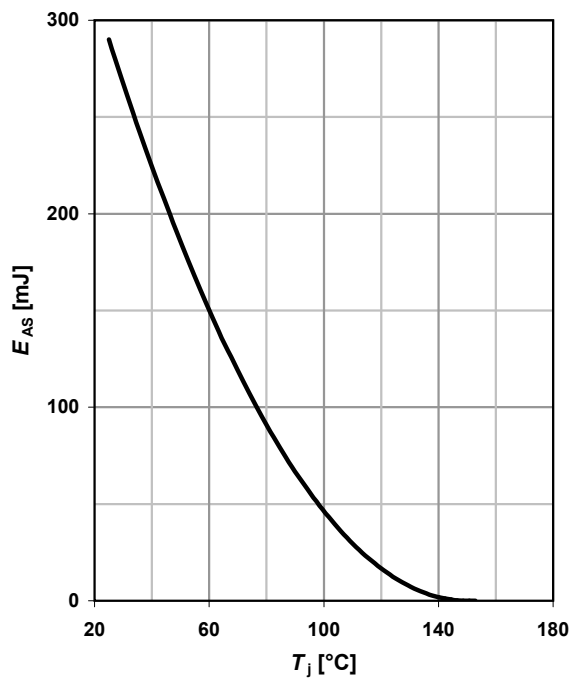

10 Forward characteristics of reverse diode

I_F=f(V_{SD})

parameter: T_j

11 Avalanche energy
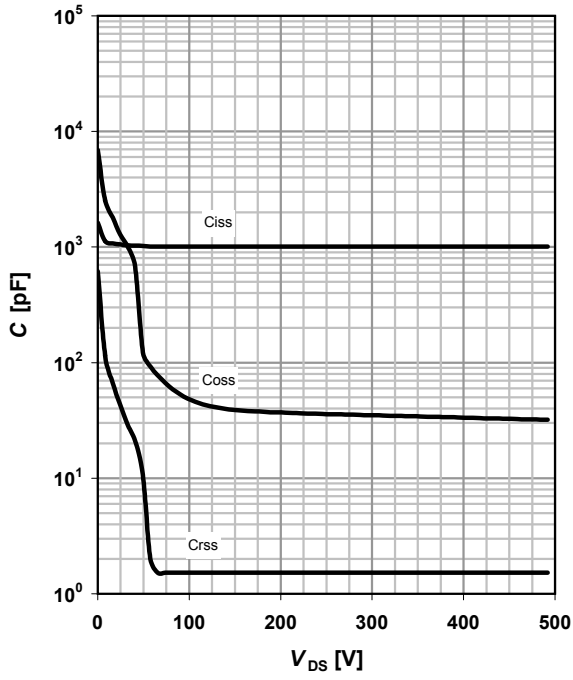
E_{AS}=f(T_j); I_D=4.4 A; V_{DD}=50 V

12 Drain-source breakdown voltage
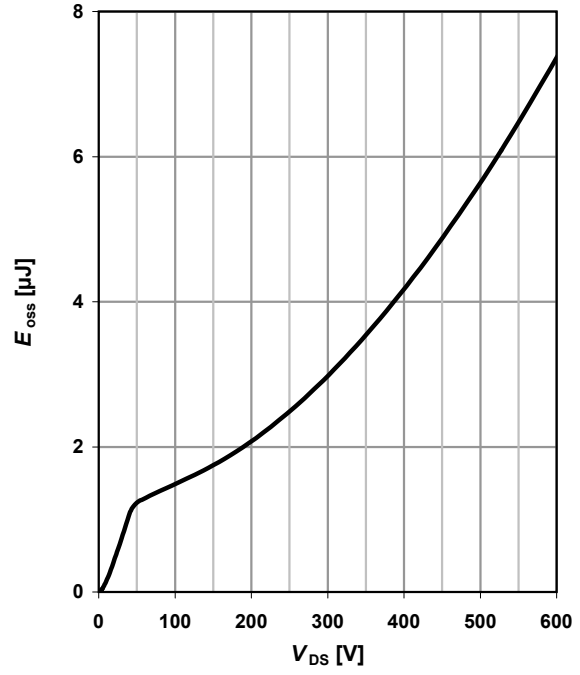
$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA

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

PG-TO247-3-21-41: Outlines
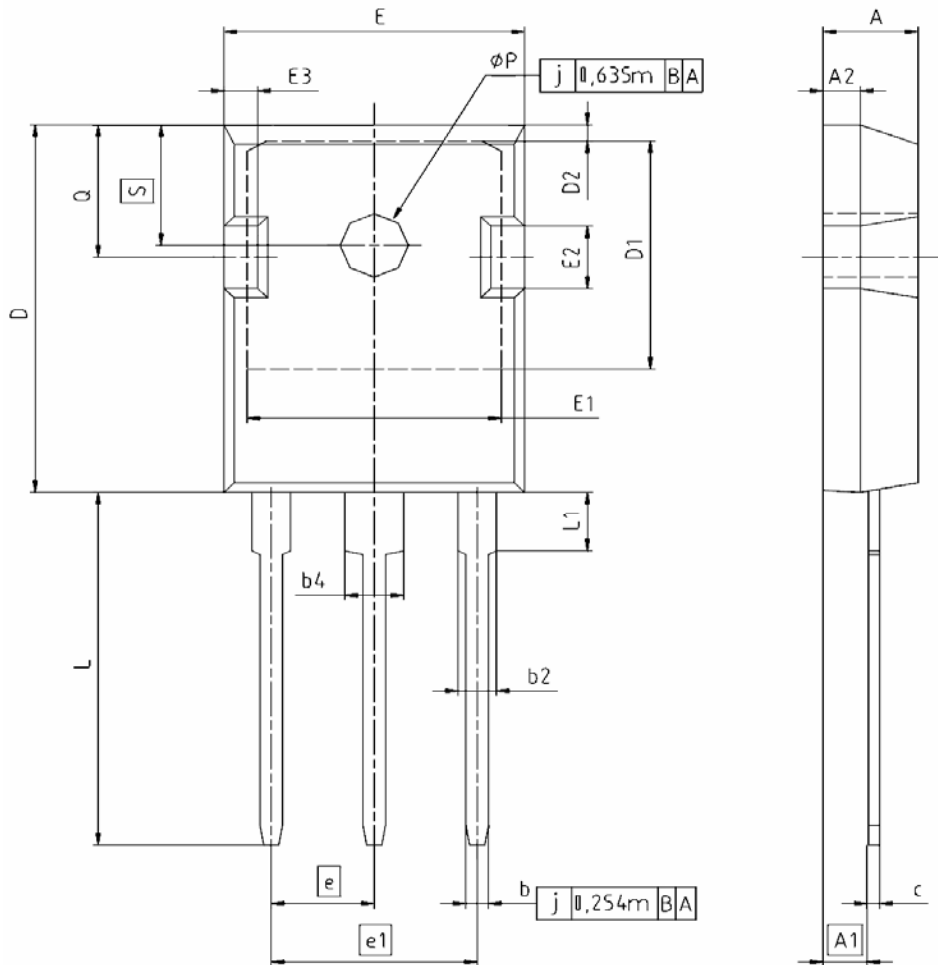
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.16	0.193	0.203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
b	1.07	1.33	0.042	0.052
b2	1.90	2.39	0.075	0.094
b4	2.87	3.45	0.113	0.136
c	0.55	0.75	0.022	0.030
D	20.82	21.10	0.820	0.831
D1	16.25	17.83	0.640	0.702
D2	1.05	1.35	0.041	0.053
E	15.70	16.03	0.618	0.631
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.68	2.60	0.066	0.102
e	5.44		0.214	
e1	10.90		0.429	
N	3		3	
L	19.80	20.31	0.780	0.799
L1	4.17	4.47	0.164	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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SCALE

EUROPEAN PROJECTION

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REVISION
02

Dimensions in mm/inches

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