CoolMOS® Power Transistor

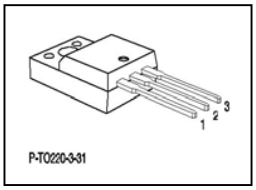
Features

- Worldwide best $R_{DS,on}$ in TO220 Fullpak
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Qualified for industrial grade applications according to JEDEC[1)]
- Pb-free lead plating; RoHS compliant; Halogen free mold compound

Product Summary

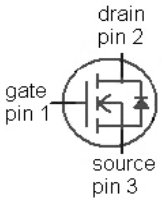
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$@T_j= 25°C	0.125	Ω
$Q_{g,typ}$	53	nC

PG-TO220



CoolMOS CP is specially designed for:

- Hard switching SMPS topologies



Type	Package	Ordering Code	Marking
IPA60R125CP	PG-TO220	SP000095275	6R125P

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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current[2)]	I_D	T_C=25 °C	25	A
		T_C=100 °C	16	
Pulsed drain current[3)]	$I_{D,pulse}$	T_C=25 °C	82	
Avalanche energy, single pulse	E_{AS}	I_D=11 A, V_{DD}=50 V	708	mJ
Avalanche energy, repetitive t_{AR}[3),4)]	E_{AR}	I_D=11 A, V_{DD}=50 V	1.2	
Avalanche current, repetitive t_{AR}[3),4)]	I_{AR}		11	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	35	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M2.5 screws	50	Ncm

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

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current[2]	I_S	T_C=25 °C	25	A
Diode pulse current[3]	$I_{S,pulse}$		82	
Reverse diode dv/dt[5]	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal characteristics						
Thermal resistance, junction - case	R_{thJC}		-	-	3.6	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	80	
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

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=1.1 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	-	-	2	µA
		V_{DS}=600 V, V_{GS}=0 V, T_j=150 °C	-	20	-	
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=16 A, T_j=25 °C	-	0.11	0.125	Ω
		V_{GS}=10 V, I_D=16 A, T_j=150 °C	-	0.30	-	
Gate resistance	R_G	f=1 MHz, open drain	-	2.1	-	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	-	2500	-	pF
Output capacitance	C_{oss}		-	120	-	
Effective output capacitance, energy related[6)]	$C_{o(er)}$	V_{GS}=0 V, V_{DS}=0 V to 480 V	-	110	-	
Effective output capacitance, time related[7)]	$C_{o(tr)}$		-	300	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=400 V, V_{GS}=10 V, I_D=16 A, R_G=3.3 Ω	-	15	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	50	-	
Fall time	t_f		-	5	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=16 A, V_{GS}=0 to 10 V	-	12	-	nC
Gate to drain charge	Q_{gd}		-	18	-	
Gate charge total	Q_g		-	53	70	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V
Reverse Diode						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=16 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	-	430	-	ns
Reverse recovery charge	Q_{rr}		-	9	-	µC
Peak reverse recovery current	I_{rrm}		-	42	-	A

[1)] J-STD20 and JESD22

[2)] Limited only by maximum temperature

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

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

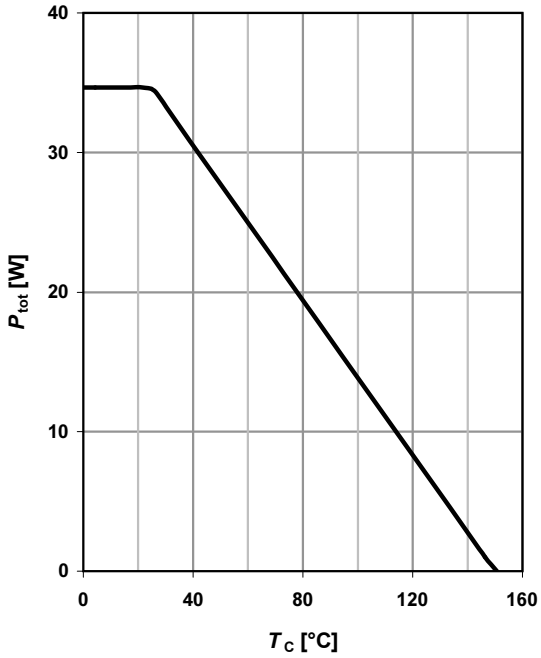
[5)] I_{SD}<=I_D, di/dt<=200A/µs, V_{DClink}=400V, V_{peak}<$V_{(BR)DSS}$, T_j<T_{jmax}, identical low-side and high side switch.

[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

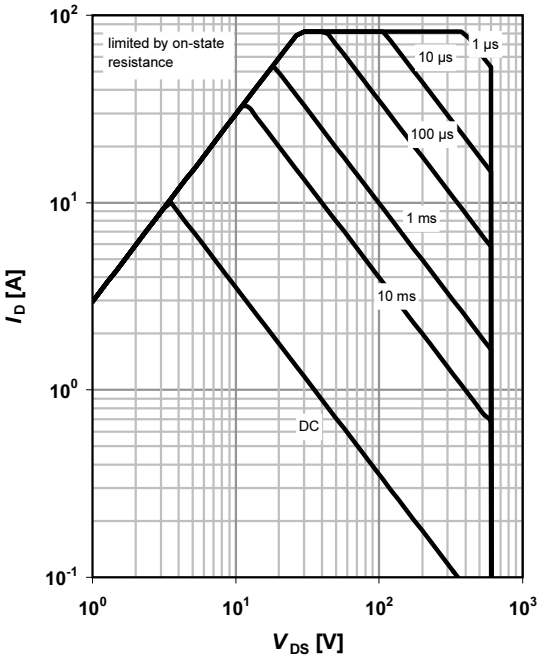
$P_{tot}=f(T_C)$



2 Safe operating area

$I_D=f(V_{DS})$; $T_C=25$ °C; $D=0$

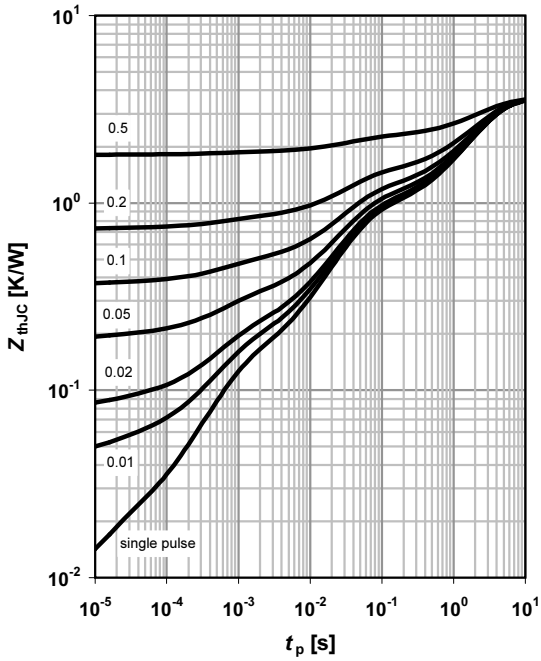
parameter: t_p



3 Max. transient thermal impedance

$I_D=f(V_{DS})$; $T_j=25$ °C

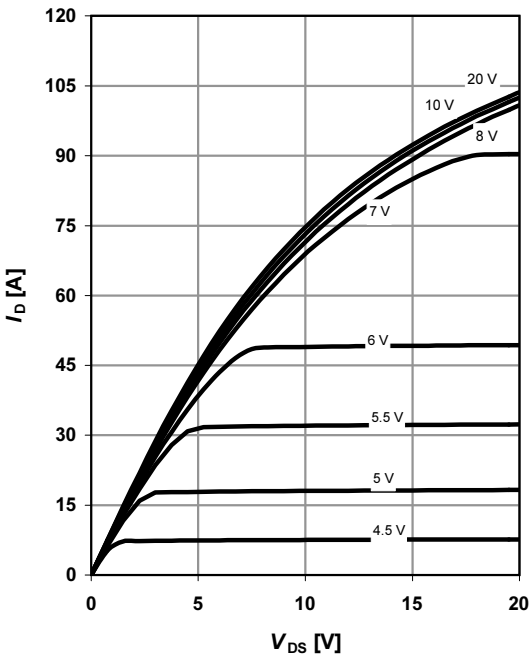
parameter: $D=t_p/T$



4 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ °C

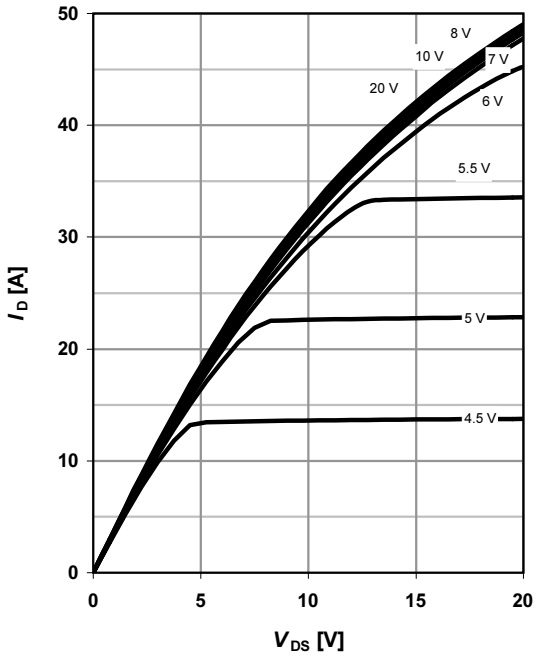
parameter: V_{GS}



5 Typ. output characteristics

I_D=f(V_{DS}); T_j=150 °C

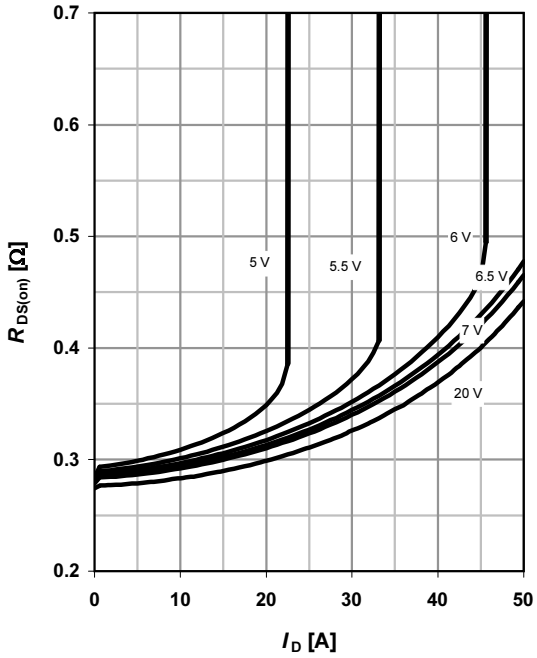
parameter: V_{GS}



6 Typ. drain-source on-state resistance

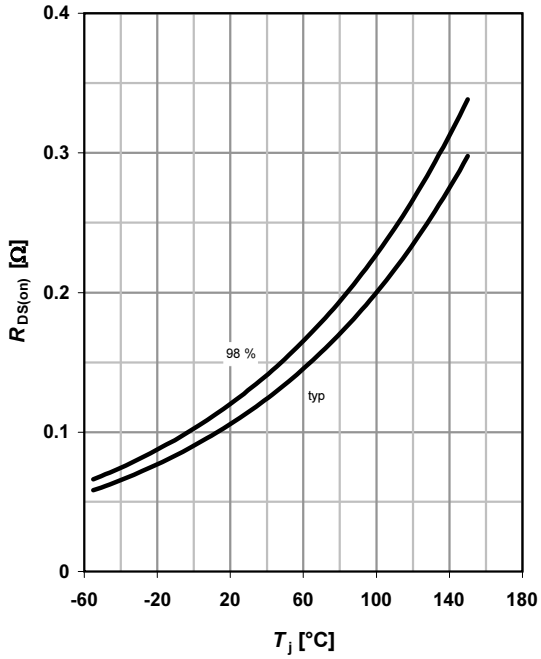
$R_{DS(on)}$=f(I_D); T_j=150 °C

parameter: V_{GS}



7 Drain-source on-state resistance

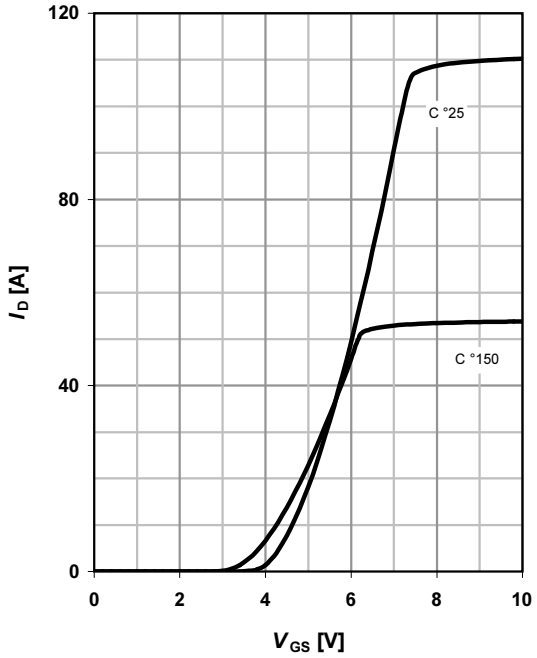
$R_{DS(on)}$=f(T_j); I_D=16 A; V_{GS}=10 V



8 Typ. transfer characteristics

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

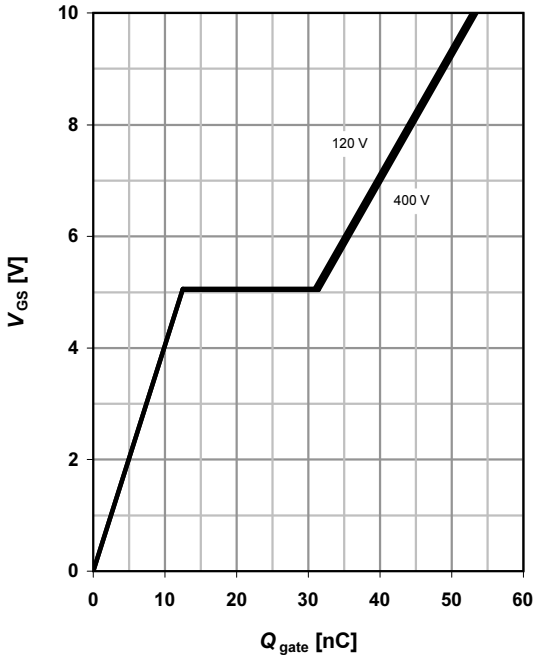
parameter: T_j



9 Typ. gate charge

V_{GS}=f(Q_{gate}); I_D=16 A pulsed

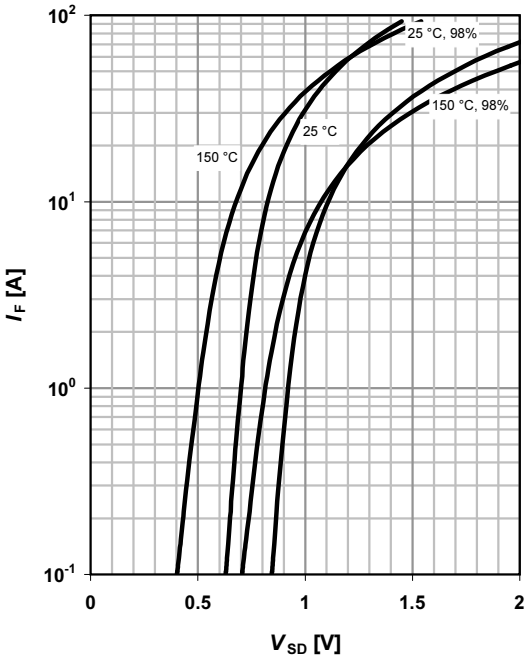
parameter: V_{DD}



10 Forward characteristics of reverse diode

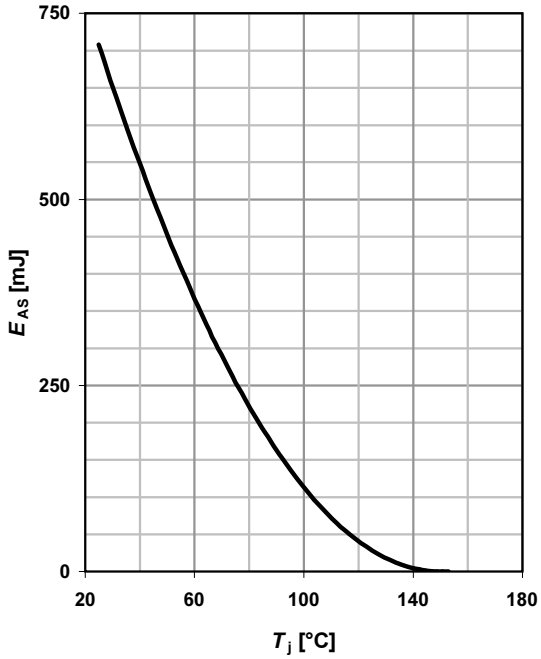
I_F=f(V_{SD})

parameter: T_j



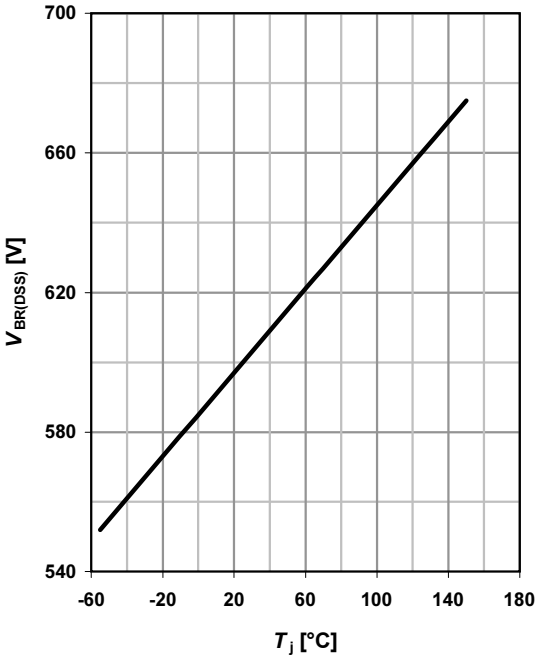
11 Avalanche energy

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



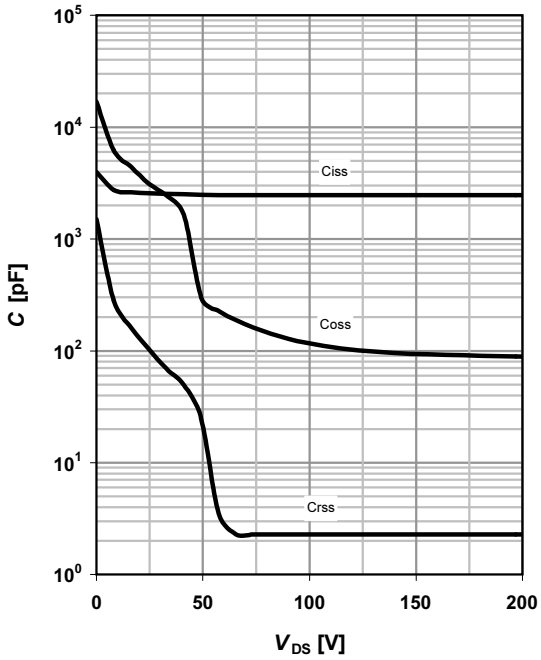
12 Drain-source breakdown voltage

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



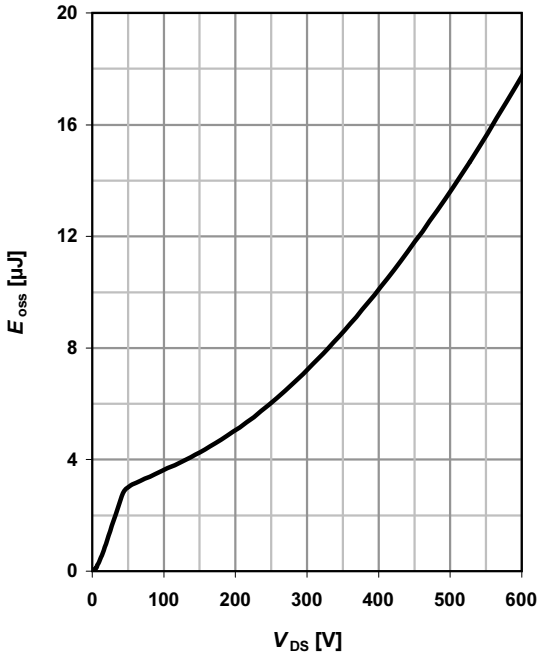
13 Typ. capacitances

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

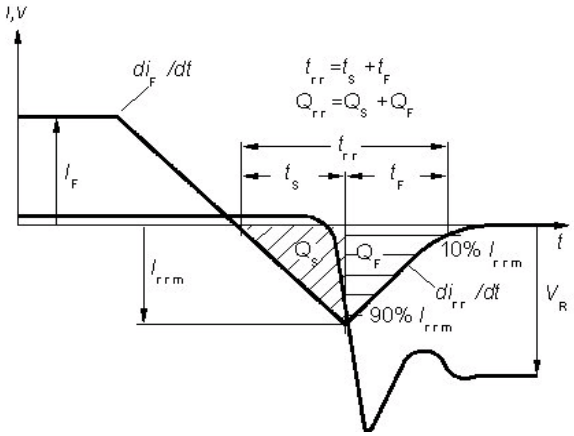


14 Typ. Coss stored energy

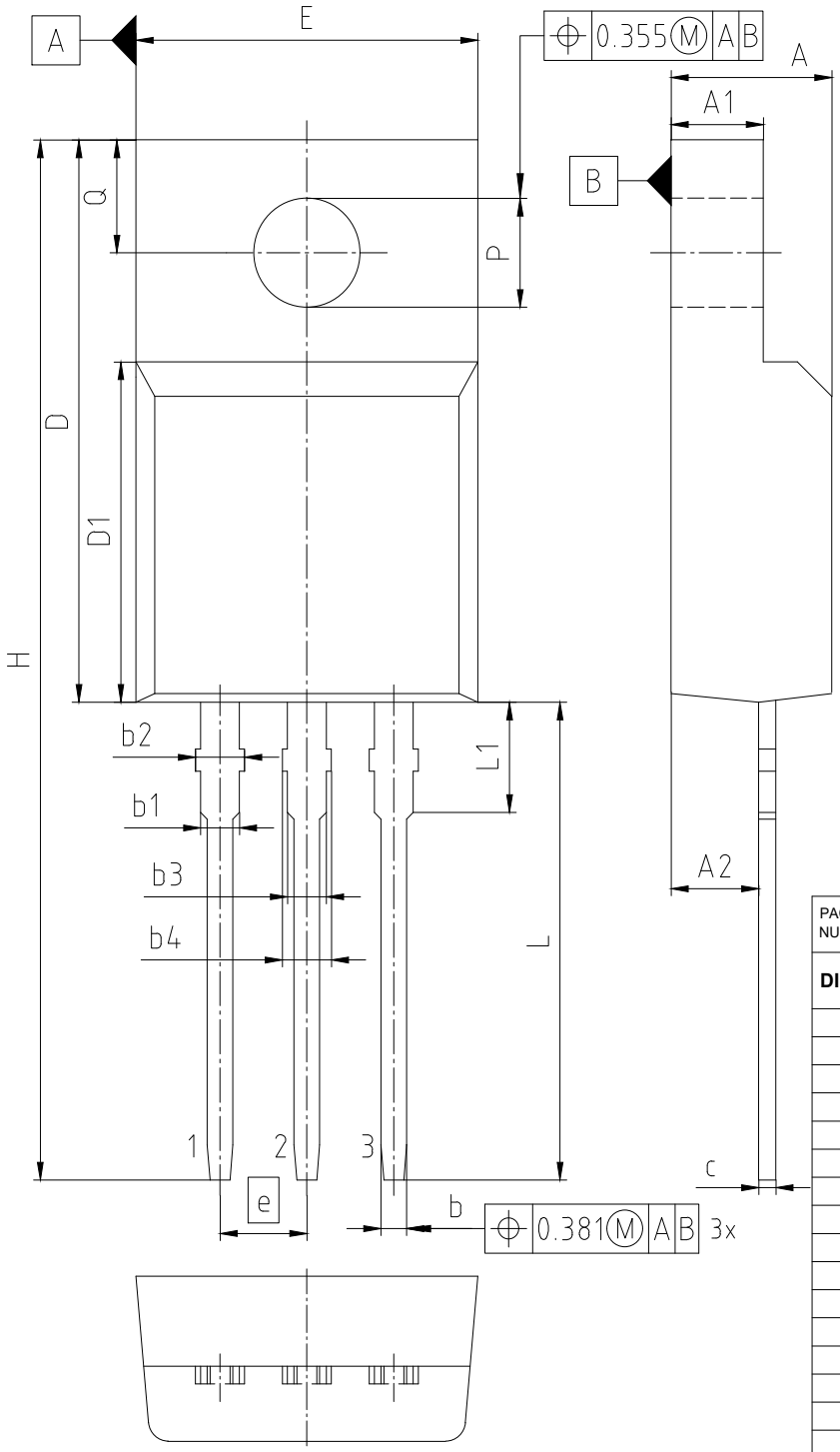
E_{oss}= f(V_{DS})



Definition of diode switching characteristics



PG-TO220-3-31/TO220-3-11: Outline/ Fully isolated package (2500VAC; 1 minute)



NOTES:
DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS
GATE BURRS ARE LESS THAN 0.5 mm

PACKAGE - GROUP NUMBER:	PG-TO220-3-U01	
DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
A	4.50	4.90
A1	2.34	2.85
A2	2.42	2.86
b	0.65	0.90
b1	0.95	1.38
b2	0.95	1.51
b3	0.65	1.38
b4	0.65	1.51
c	0.40	0.63
D	15.67	16.15
D1	8.97	9.83
E	10	10.65
e	2.54	
N	3	
H	28.70	29.75
L	12.78	13.75
L1	2.83	3.45
øP	3.00	3.30
Q	3.15	3.50

Dimension in mm

Revision history

IPA60R125CP

Revision 2025-02-11, Rev. 2.2

Previous revisions

Revision	Date	Subjects (major changes since last revision)
2.2	2025-02-11	New standardized Infineon umbrella-template for package drawings including change of parameter P

Trademarks
All referenced product or service names and trademarks are the property of their respective owners.

We Listen to Your Comments Any information within this document that you feel is wrong, unclear or missing at all? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to: **erratum@infineon.com**

Published by
Infineon Technologies AG
81726 München, Germany

Important notice
The products which may also include samples and may be comprised of hardware or software or both ("Product") are sold or provided and delivered by Infineon Technologies AG and its affiliates ("Infineon") subject to the terms and conditions of the frame supply contract or other written agreement(s) executed by a customer and Infineon or, in the absence of the foregoing, the applicable Sales Conditions of Infineon. General terms and conditions of a customer or deviations from applicable Sales Conditions of Infineon shall only be binding for Infineon if and to the extent Infineon has given its express written consent.

For the avoidance of doubt, Infineon disclaims all warranties of non-infringement of third-party rights and implied warranties such as warranties of fitness for a specific use/purpose or merchantability.

Infineon shall not be responsible for any information with respect to samples, the application or customer's specific use of any Product or for any examples or typical values given in this document.

The data contained in this document is exclusively intended for technically qualified and skilled customer representatives. It is the responsibility of the customer to evaluate the suitability of the Product for the intended application and the customer's specific use and to verify all relevant technical data contained in this document in the intended application and the customer's specific use. The customer is responsible for properly designing, programming, and testing the functionality and safety of the intended application, as well as complying with any legal requirements related to its use.

Unless otherwise explicitly approved by Infineon, Products may not be used in any application where a failure of the Product or any consequences of the use thereof can reasonably be expected to result in personal injury. However, the foregoing shall not prevent the customer from using any Product in such fields of use that Infineon has explicitly designed and sold it for, provided that the overall responsibility for the application lies with the customer.

If the Product includes security features:
Because no computing device can be absolutely secure, and despite security measures implemented in the Product, Infineon does not guarantee that the Product will be free from intrusion, data theft or loss, or other breaches ("Security Breaches"), and Infineon shall have no liability arising out of any Security Breaches.

If this document includes or references software:
The software is owned by Infineon under the intellectual property laws and treaties of the United States, Germany, and other countries worldwide. All rights reserved. Therefore, you may use the software only as provided in the software license agreement accompanying the software. If no software license agreement applies, Infineon hereby grants you a personal, non-exclusive, non-transferable license (without the right to sublicense) under its intellectual property rights in the software (a) for software provided in source code form, to modify and reproduce the software solely for use with Infineon hardware products, only internally within your organization, and (b) to distribute the software in binary code form externally to end users, solely for use on Infineon hardware products. Any other use, reproduction, modification, translation, or compilation of the software is prohibited.

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office (www.infineon.com).