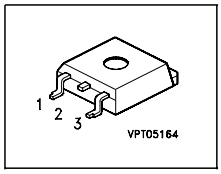
Cool MOS™ Power Transistor

V_{DS}	600	V
$R_{DS(on)}$	3	Ω
I_D	1.8	A

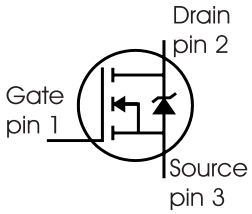
Feature

- New revolutionary high voltage technology
- Ultra low gate charge
- Periodic avalanche rated
- Extreme d*v*/d*t* rated
- Ultra low effective capacitances
- Improved transconductance
- Qualified according to JEDEC[0)] for target applications

PG-TO263



Type	Package	Ordering Code	Marking
SPB02N60S5	PG-TO263	Q67040-S4212	02N60S5



Maximum Ratings

Parameter	Symbol	Value	Unit
Continuous drain current	I_D		A
T_C = 25 °C		1.8	
T_C = 100 °C		1.1	
Pulsed drain current, t_p limited by T_{jmax}	$I_{D\ puls}$	3.2	
Avalanche energy, single pulse	E_{AS}	50	mJ
I_D = 1.35 A, V_{DD} = 50 V			
Avalanche energy, repetitive t_{AR} limited by T_{jmax}[1]	E_{AR}	0.07	
I_D = 1.8 A, V_{DD} = 50 V			
Avalanche current, repetitive t_{AR} limited by T_{jmax}	I_{AR}	1.8	A
Gate source voltage	V_{GS}	±20	V
Gate source voltage AC (f >1Hz)	V_{GS}	±30	
Power dissipation, T_C = 25°C	P_{tot}	25	W
Operating and storage temperature	T_j , T_{stg}	-55... +150	°C

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain Source voltage slope V_{DS} = 480 V, I_D = 1.8 A, T_j = 125 °C	dv/dt	20	V/ns

Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Thermal resistance, junction - case	R_{thJC}	-	-	5	K/W
Thermal resistance, junction - ambient, leaded	R_{thJA}	-	-	62	
SMD version, device on PCB: @ min. footprint @ 6 cm^2 cooling area [2)]	R_{thJA}	 - -	 - 35	 62 -	
Soldering temperature, reflow soldering, MSL1 1.6 mm (0.063 in.) from case for 10s	T_{sold}	-	-	260	°C

Electrical Characteristics, at Tj=25°C unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=0.25mA	600	-	-	V
Drain-Source avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS}=0V, I_D=1.8A	-	700	-	
Gate threshold voltage	$V_{GS(th)}$	I_D=80µA, V_{GS}=V_{DS}	3.5	4.5	5.5	
Zero gate voltage drain current	I_{DSS}	V_{DS}=600V, V_{GS}=0V, T_j=25°C, T_j=150°C	 - -	 0.5 -	 1 50	µA
Gate-source leakage current	I_{GSS}	V_{GS}=20V, V_{DS}=0V	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=1.1A, T_j=25°C T_j=150°C	 - -	 2.7 7.3	 3 -	Ω

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Characteristics						
Transconductance	g_{fs}	$V_{DS}\geq 2*I_D*R_{DS(on)max}$, I_D=1.1A	-	1.4	-	S
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	240	-	pF
Output capacitance	C_{oss}		-	77	-	
Reverse transfer capacitance	C_{rss}		-	4.4	-	
Turn-on delay time	$t_{d(on)}$	V_{DD}=350V, V_{GS}=0/10V, I_D=1.8A, R_G=50Ω	-	35	-	ns
Rise time	t_r		-	35	-	
Turn-off delay time	$t_{d(off)}$		-	35	42	
Fall time	t_f		-	20	30	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DD}=350V, I_D=1.8A	-	2.3	-	nC
Gate to drain charge	Q_{gd}		-	4.5	-	
Gate charge total	Q_g	V_{DD}=350V, I_D=1.8A, V_{GS}=0 to 10V	-	7.3	9.5	
Gate plateau voltage	$V_{(plateau)}$	V_{DD}=350V, I_D=1.8A	-	8	-	V

[0]J-STD20 and JESD22

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

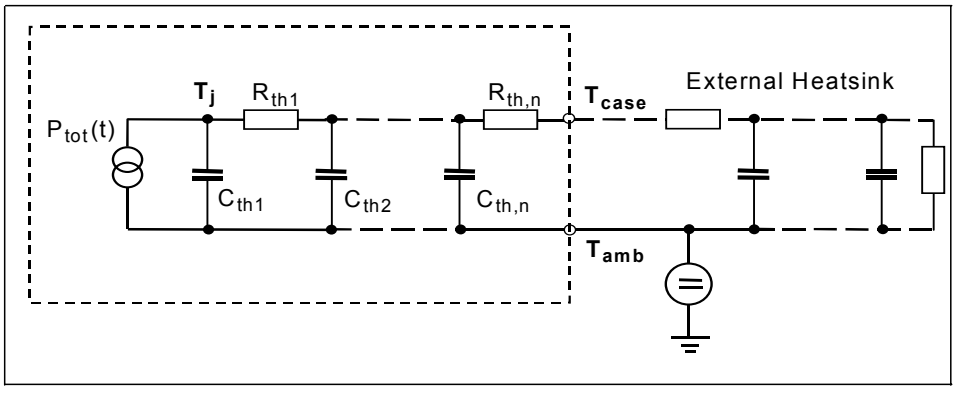
[2]Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical without blown air.

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Inverse diode continuous forward current	I_S	T_C=25°C	-	-	1.8	A
Inverse diode direct current, pulsed	I_{SM}		-	-	3.2	
Inverse diode forward voltage	V_{SD}	V_{GS}=0V, I_F=I_S	-	1	1.2	V
Reverse recovery time	t_{rr}	V_R=350V, I_F=I_S ,	-	860	1460	ns
Reverse recovery charge	Q_{rr}	di_F/dt=100A/µs	-	1.6	-	µC

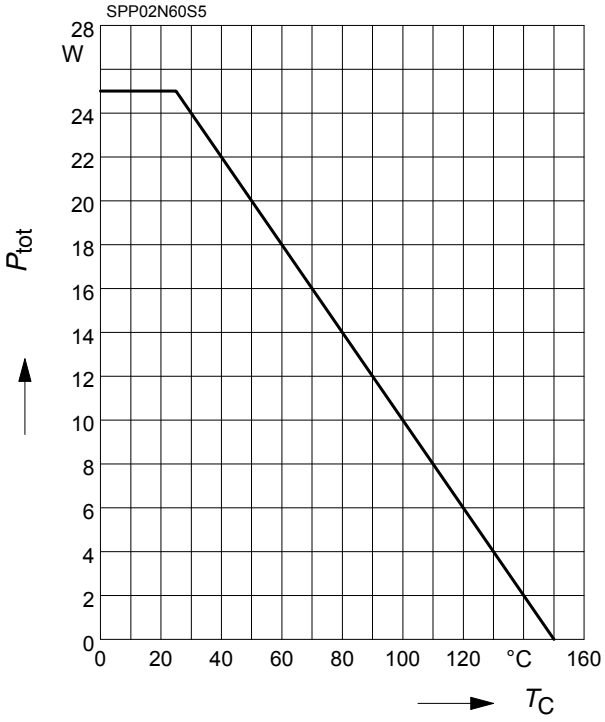
Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
	typ.			typ.	
Thermal resistance			Thermal capacitance		
R_{th1}	0.1	K/W	C_{th1}	0.00002806	Ws/K
R_{th2}	0.184		C_{th2}	0.0001113	
R_{th3}	0.306		C_{th3}	0.0001679	
R_{th4}	1.207		C_{th4}	0.000547	
R_{th5}	0.974		C_{th5}	0.001388	
R_{th6}	0.251		C_{th6}	0.019	



1 Power dissipation

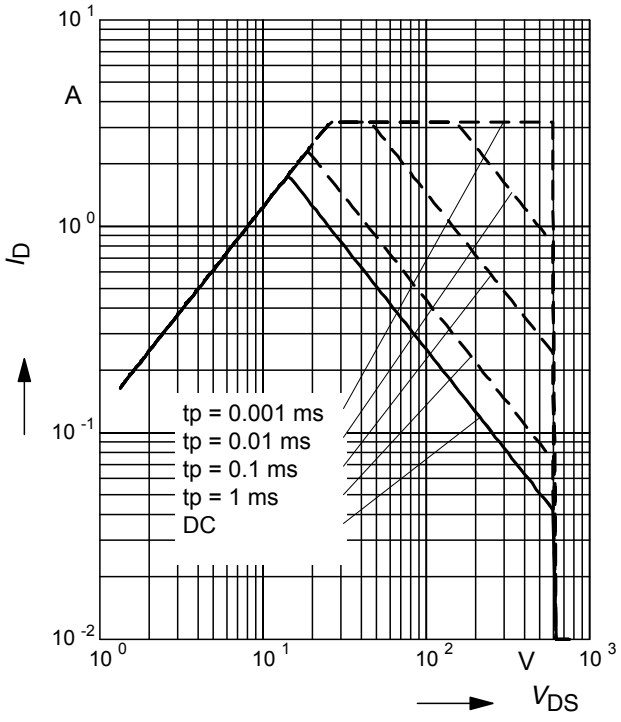
$P_{tot} = f(T_C)$



2 Safe operating area

$I_D = f(V_{DS})$

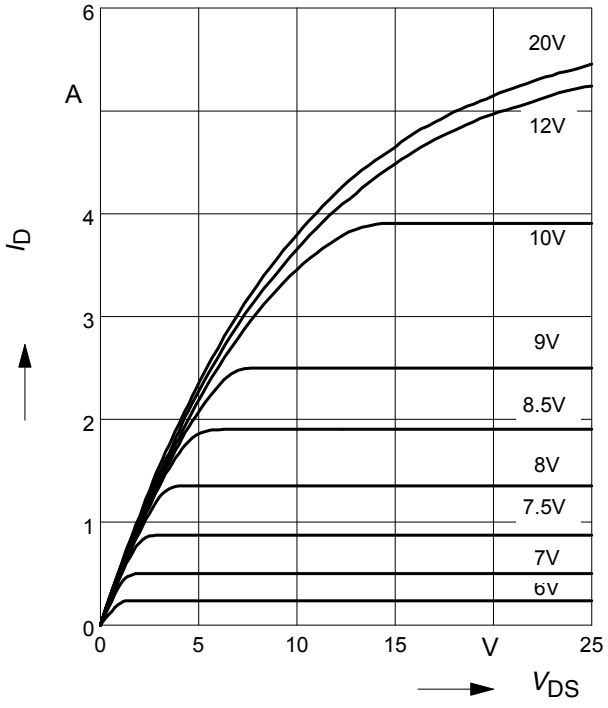
parameter : $D = 0$, $T_C = 25°C$



3 Typ. output characteristic

$I_D = f(V_{DS})$; $T_j = 25°C$

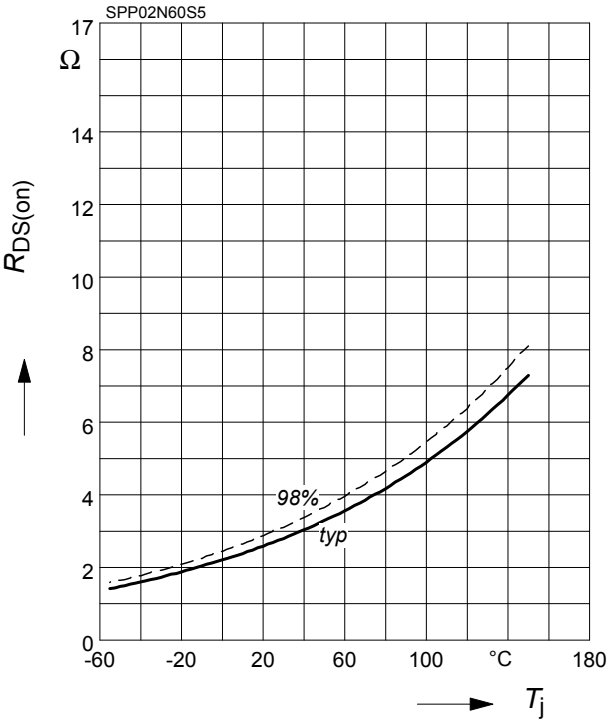
parameter: $t_p = 10$ µs, V_{GS}



4 Drain-source on-state resistance

$R_{DS(on)} = f(T_j)$

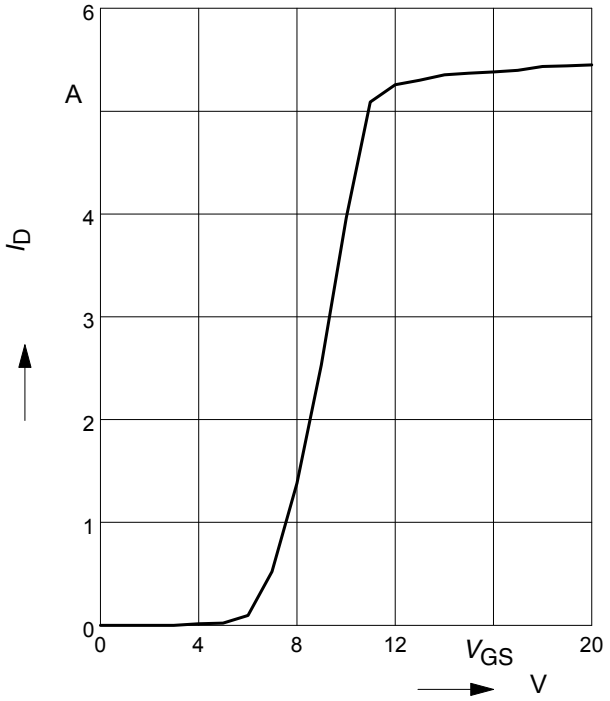
parameter : $I_D = 1.1$ A, $V_{GS} = 10$ V



5 Typ. transfer characteristics

$I_D = f(V_{GS})$; $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$

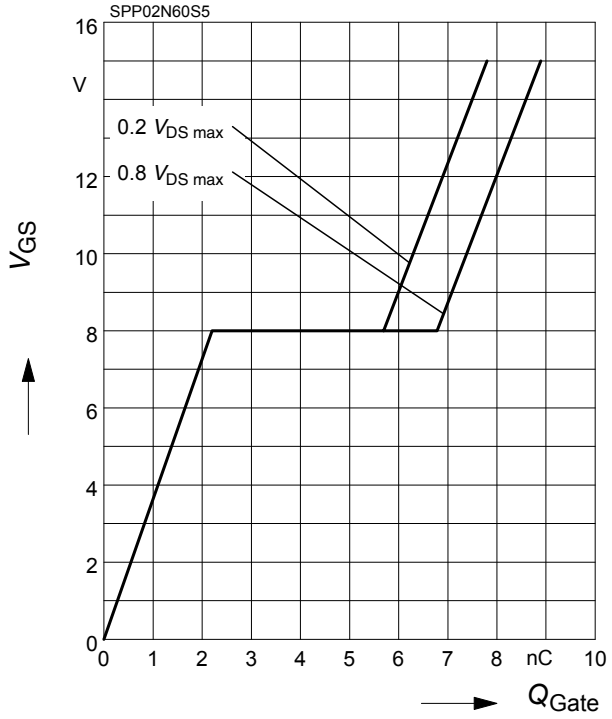
parameter: t_p = 10 µs



6 Typ. gate charge

$V_{GS} = f(Q_{Gate})$

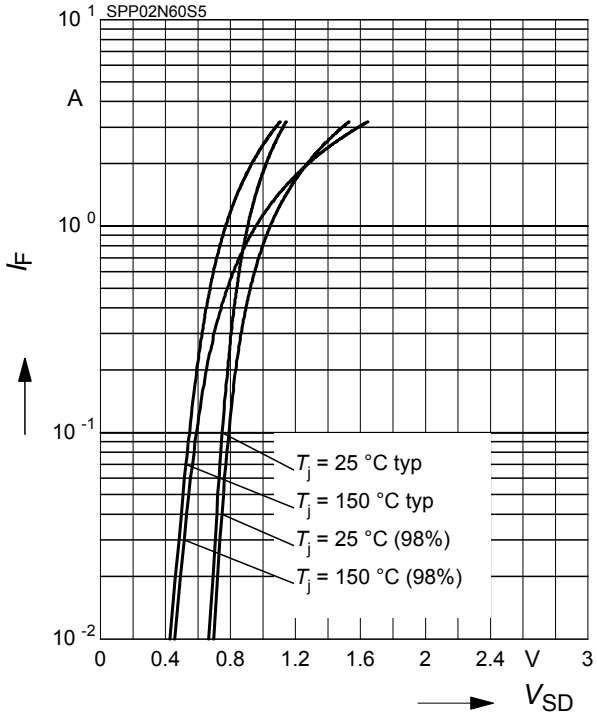
parameter: I_D = 1.8 A pulsed



7 Forward characteristics of body diode

$I_F = f(V_{SD})$

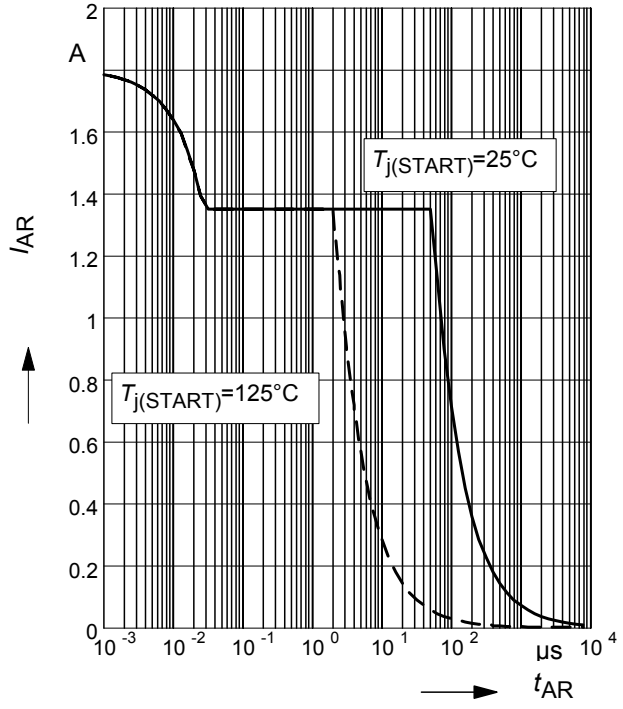
parameter: T_j , tp = 10 µs



8 Avalanche SOA

$I_{AR} = f(t_{AR})$

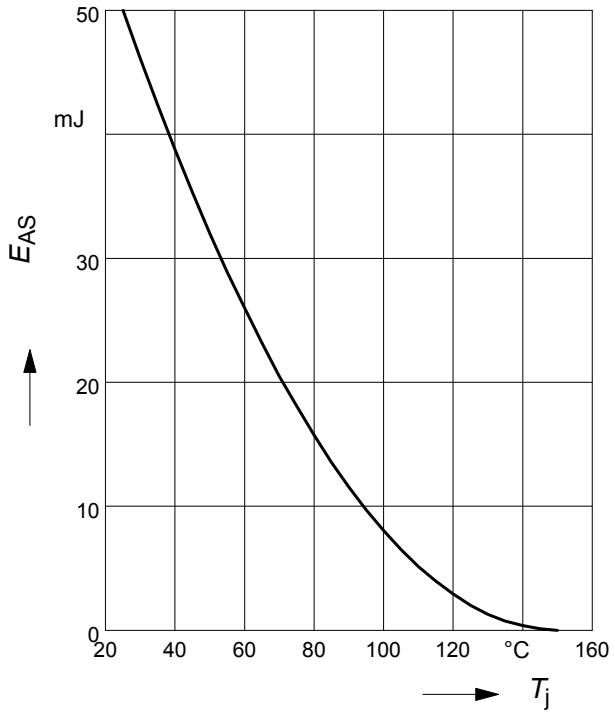
par.: $T_j \leq 150$ °C



9 Avalanche energy

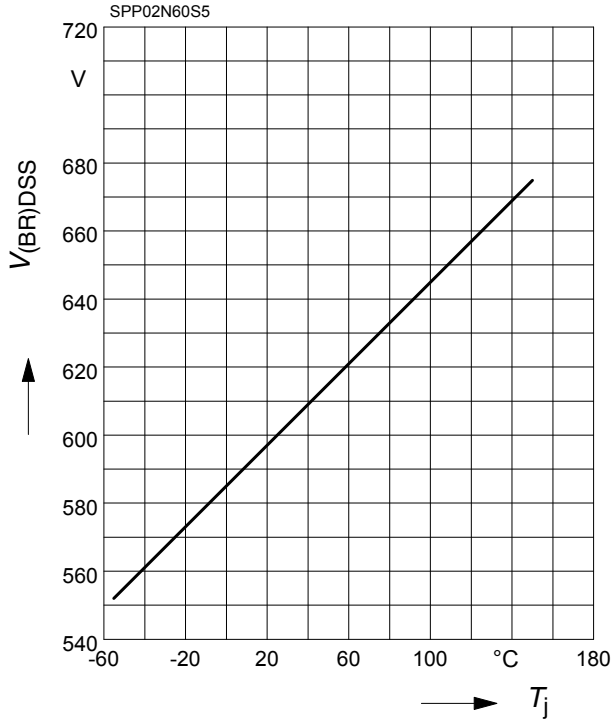
$E_{AS} = f(T_j)$

par.: I_D = 1.35 A, V_{DD} = 50 V



10 Drain-source breakdown voltage

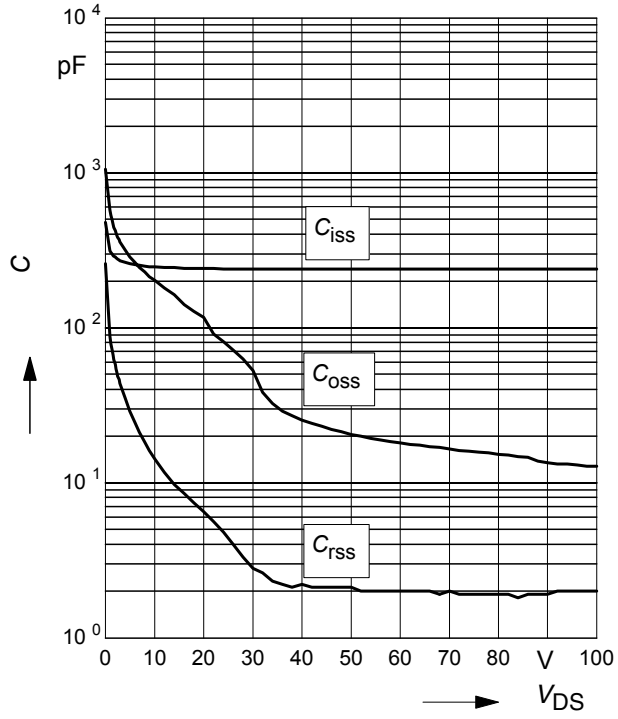
$V_{(BR)DSS} = f(T_j)$



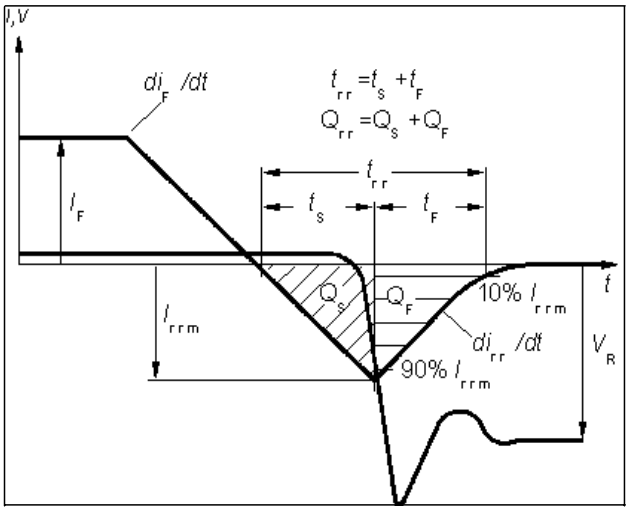
11 Typ. capacitances

$C = f(V_{DS})$

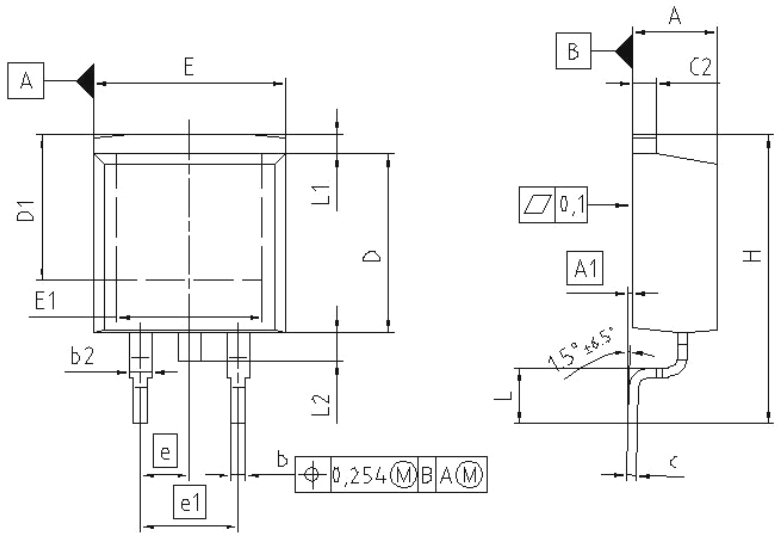
parameter: V_{GS}=0V, f=1 MHz



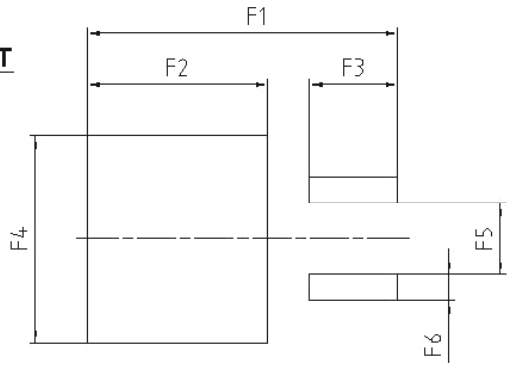
Definition of diodes switching characteristics



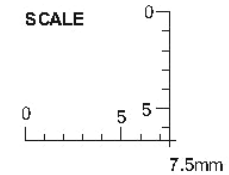
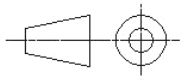
PG-TO263-3-2, PG-TO263-3-5, PG-TO263-3-22



FOOTPRINT



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.300	4.572	0.169	0.180
A1	0.000	0.254	0.000	0.010
b	0.650	0.850	0.026	0.033
b2	0.950	1.321	0.037	0.052
c	0.330	0.650	0.013	0.026
c2	0.170	1.400	0.046	0.055
D	8.509	9.450	0.335	0.372
D1	7.100	-	0.280	-
E	9.800	10.312	0.386	0.406
E1	6.500		0.256	
e	2.540		0.100	
e1	5.080		0.200	
N	2		2	
H	14.605	15.875	0.575	0.625
L	2.200	3.000	0.087	0.118
L1	-	1.600	-	0.063
L2	1.000	1.778	0.039	0.070
F1	16.050	16.250	0.632	0.640
F2	9.300	9.500	0.366	0.374
F3	4.500	4.700	0.177	0.185
F4	10.700	10.900	0.421	0.429
F5	3.630	3.830	0.143	0.151
F6	1.100	1.300	0.043	0.051

REFERENCE JEDEC TO263
SCALE 
EUROPEAN PROJECTION 
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