

Semiconductor Co., Ltd.

SE20NS65

N-Channel Enhancement-Mode MOSFET

Revision: A

General Description

Thigh Density Cell Design For Ultra Low On-Resistance Fully Characterized Avalanche Voltage and Current Improved Shoot-Through FOM

- Simple Drive Requirement
- Small Package Outline
- Surface Mount Device

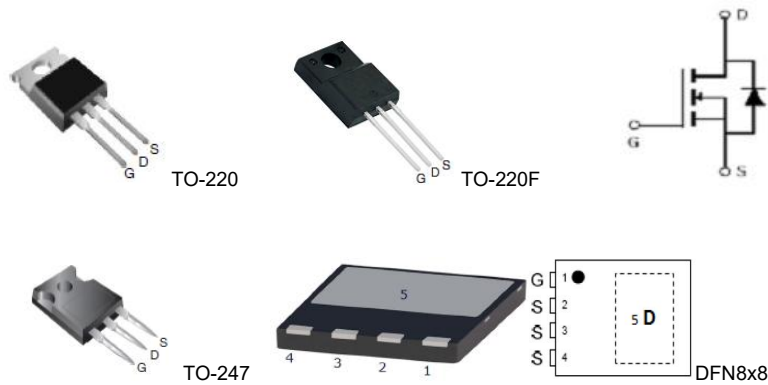
Features

For a single MOSFET

- $V_{DS} = 650V$
- $R_{DS(ON)} = 160m\Omega @ V_{GS}=10V$

Pin configurations

See Diagram below



Absolute Maximum Ratings

Parameter		Symbol	Rating	Units
Drain-Source Voltage		V_{DS}	650	V
Gate-Source Voltage		V_{GS}	± 30	V
Drain Current	Continuous	I_D	20	A
	Pulsed		64	
Avalanche Energy, Single Pulse		E_{AS}	485	mJ
Avalanche Current, Repetitive		I_{AR}	3.5	A
Total Power Dissipation	@TA=25°C	P_D	208	W
Operating Junction Temperature Range		T_J	-55 to 150	°C

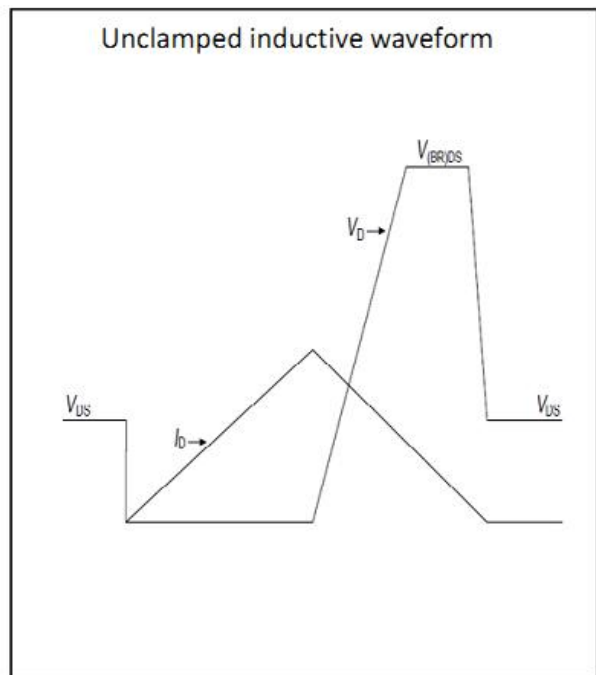
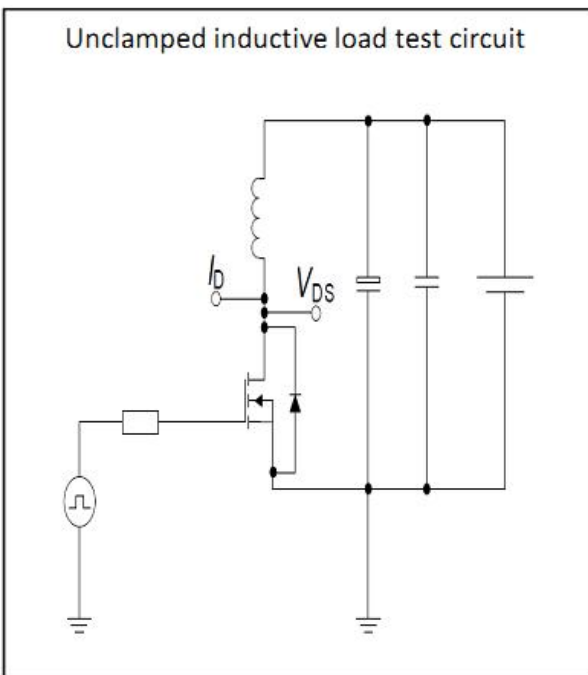
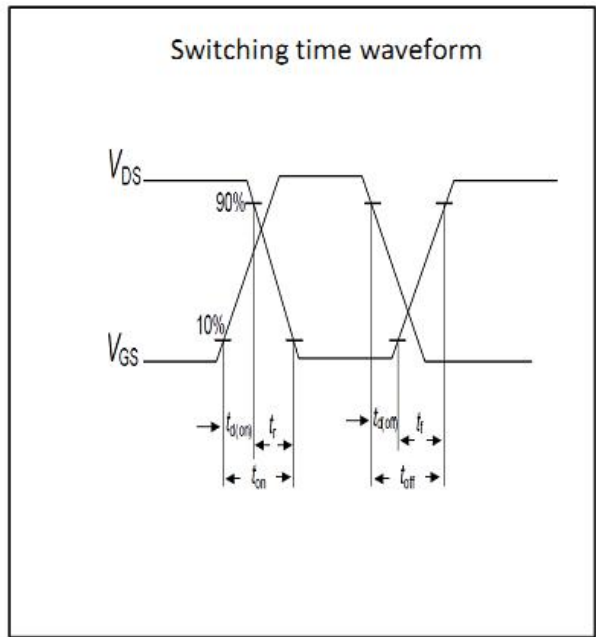
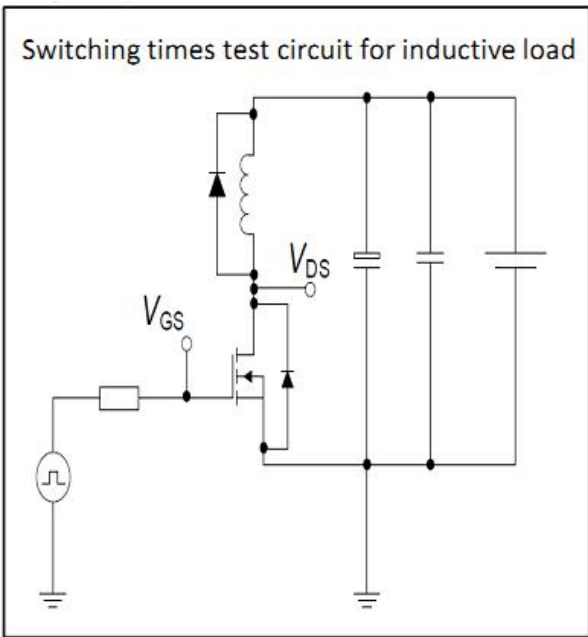
Thermal Resistance

Symbol	Parameter	Min	Typ	Units
$R_{\theta JC}$	Junction to Case		0.6	°C/W
$R_{\theta JA}$	Junction to Ambient ($t \leq 10s$)		62	°C/W

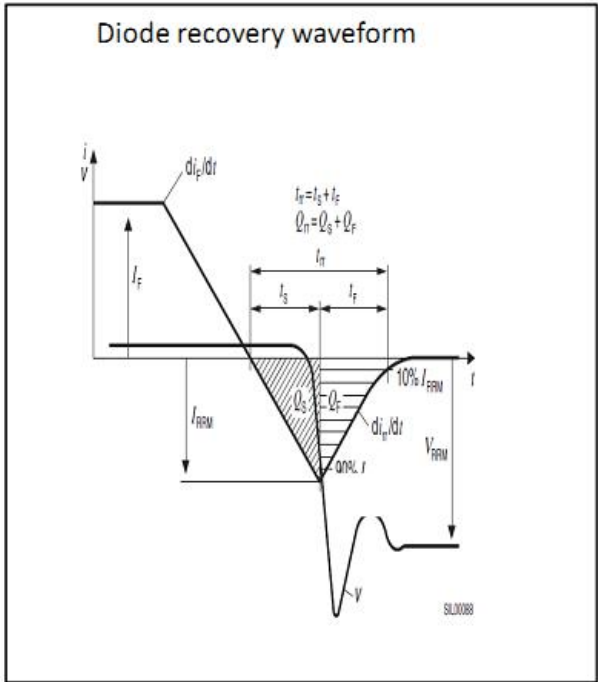
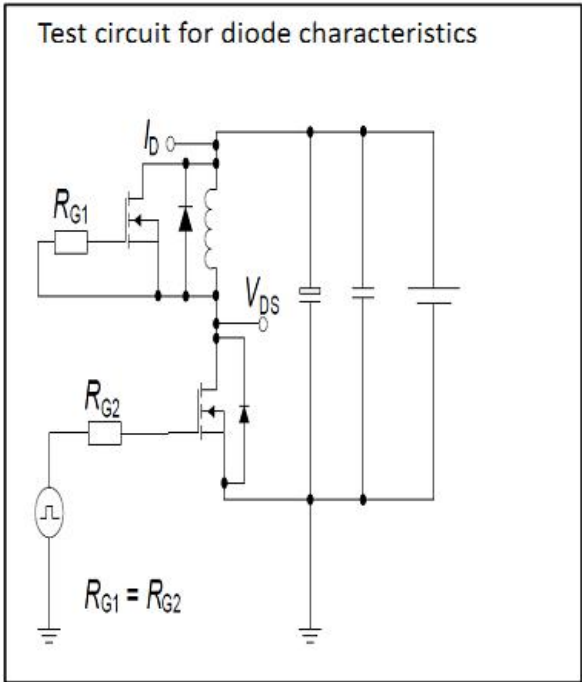
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Electrical Characteristics (T _J =25°C unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS (Note 2)						
B _V DSS	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0 V	650			V
I _{DSS}	Drain to Source Leakage Current	V _{DS} = 650V, V _{GS} =0V			1	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =30 V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D =250μA	2.5		4.5	V
R _{DS(ON)}	Static Drain-Source On-Resistance ²	V _{GS} =10V, I _D =5A		160	190	mΩ
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =25V, f=1MHz		1440		pF
C _{oss}	Output Capacitance			300		pF
C _{rss}	Reverse Transfer Capacitance			10		pF
SWITCHING PARAMETERS						
Q _g	Total Gate Charge ²	V _{GS} =10V, V _{DS} =480V, I _D =10A		70	90	nC
Q _{gs}	Gate Source Charge			7.8		nC
Q _{gd}	Gate Drain Charge			9		nC
t _{d(on)}	Turn-On Delay Time	V _{GS} =10V, V _{DS} =400V, R _{GEN} =20Ω I _D =5A		25		ns
t _{d(off)}	Turn-Off Delay Time			70		ns
t _{d(r)}	Turn-On Rise Time			55		ns
t _{d(f)}	Turn-Off Fall Time			40		ns
Source-Drain Diode Characteristics						
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} =0V, I _S =10A		1.0	1.5	V
I _S	Max Drain-Source Diode Current				20	A
I _{SM}	Max Pulse Drain-Source Current				60	A
t _{rr}	Reverse Recovery Time	VR=480V, I _S =20A		500		ns
Q _{RR}	Reverse Recovery Charge	di _f /dt=100A/μs		6		μC

Test Circuits and Waveform



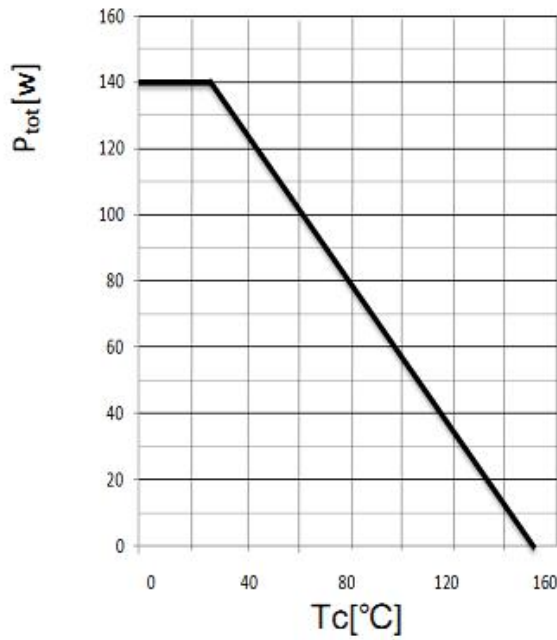
Test Circuits and Waveform



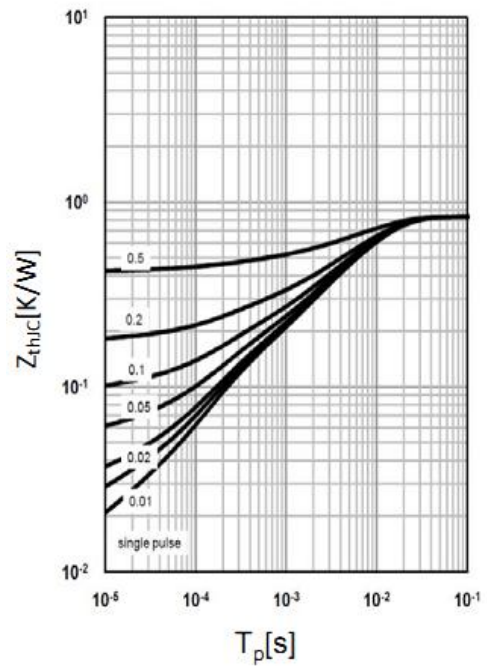
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Typical Characteristics

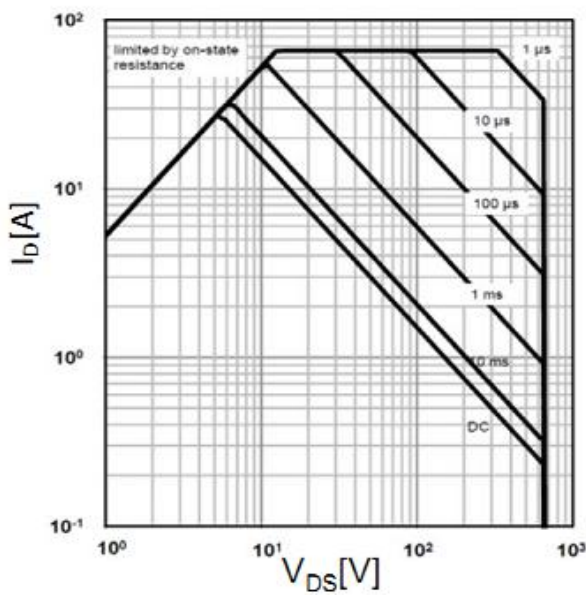
Power dissipation
TO-220P



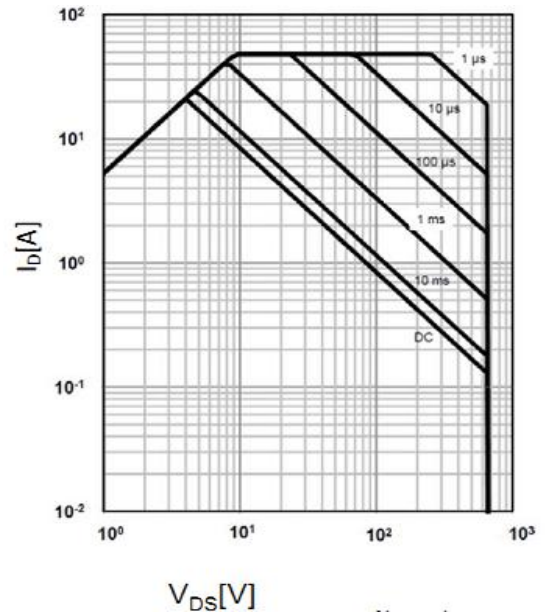
Max. transient thermal impedance
TO-220P



Safe operation area TC=25°C

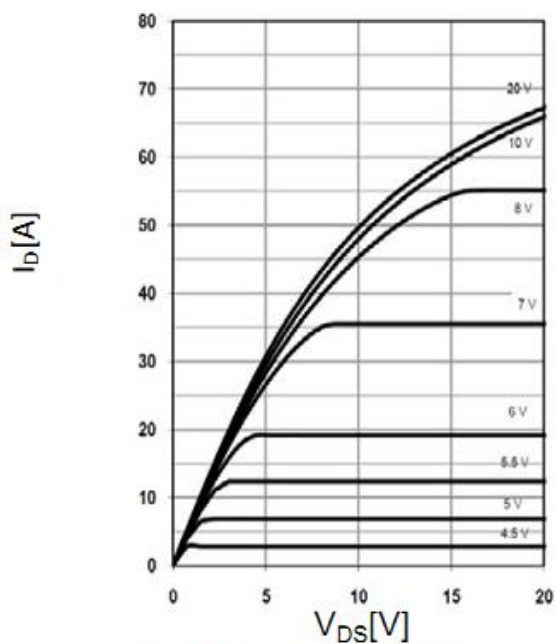


Safe operation area TC=80°C



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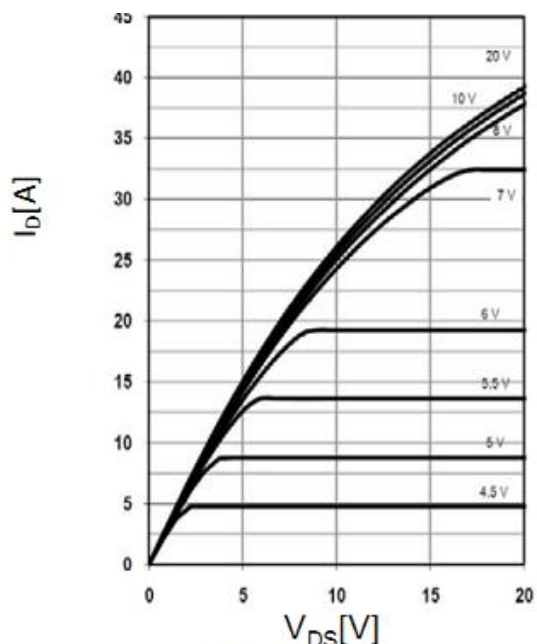
Output characteristics at TC=25°C



$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C}$; parameter: V_{GS}

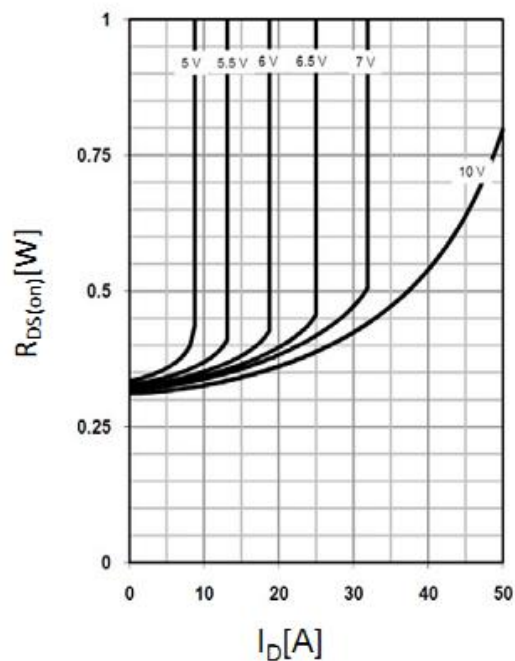
Typ. drain-source on-state resistance

Output characteristics at TC=125°C

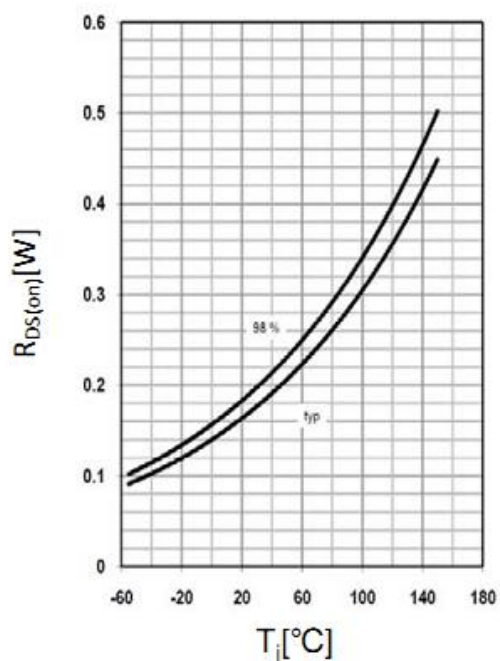


$I_D=f(V_{DS}); T_j=125\text{ }^\circ\text{C}$; parameter: V_{GS}

Typ. drain-source on-state resistance

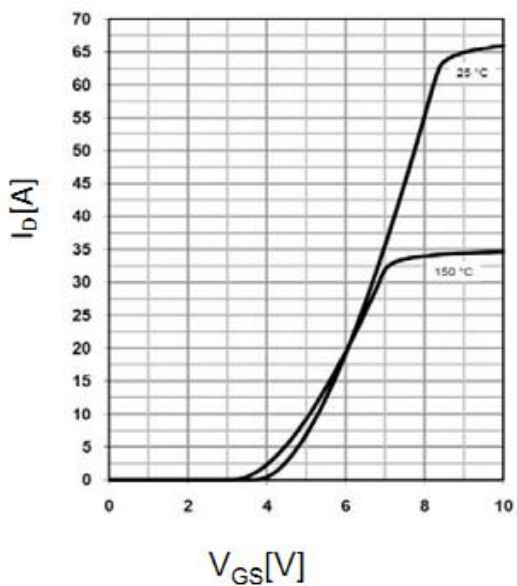


$R_{DS(on)}=f(I_D); T_j=125\text{ }^\circ\text{C}$; parameter: V_{GS}



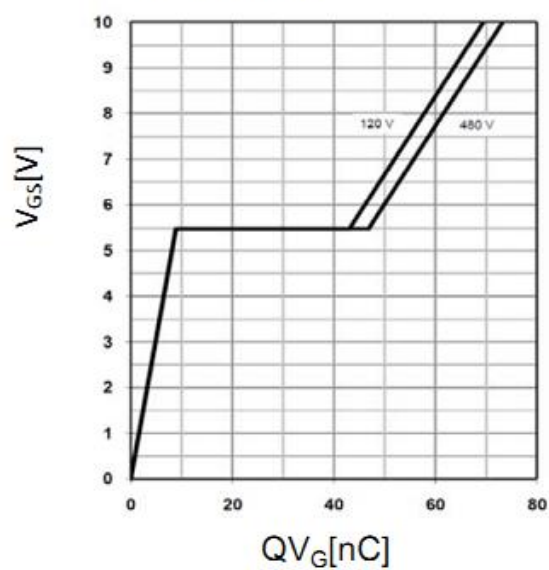
$R_{DS(on)}=f(T_j); I_D=7.3\text{ A}; V_{GS}=10\text{ V}$

Typ. transfer characteristics



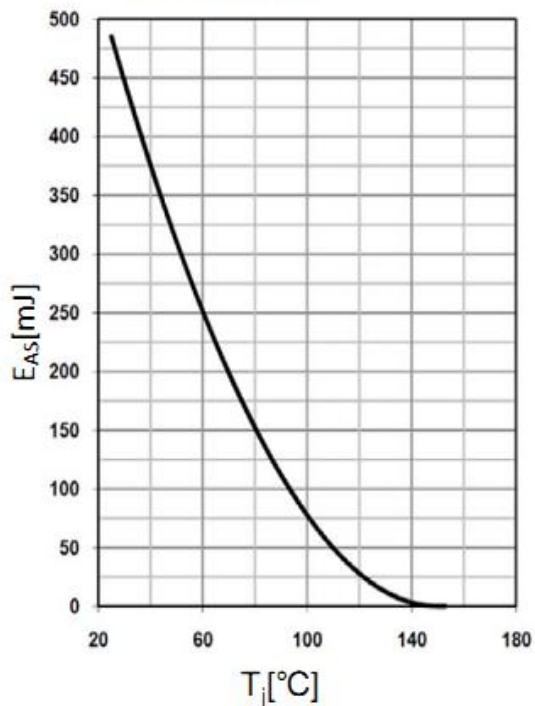
$I_D = f(V_{GS}); V_{DS} = 20V$

Typ. gate charge



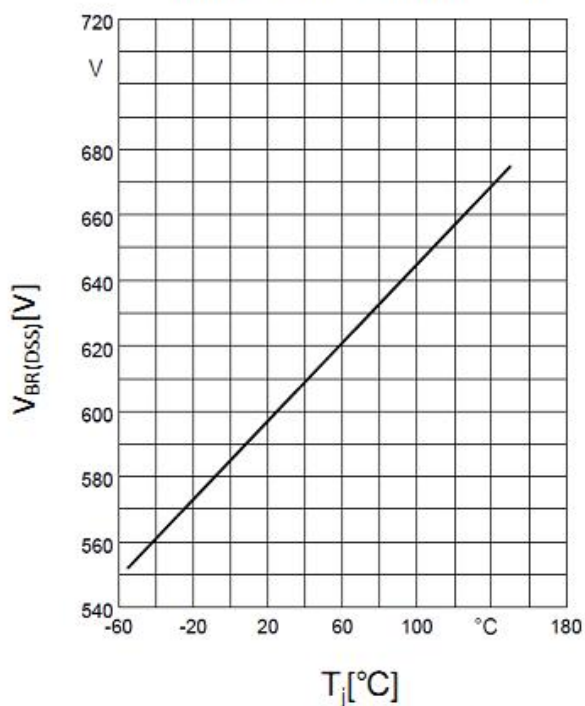
$V_{GS} = f(Q_g), I_D = 11 A$ pulsed

Avalanche energy

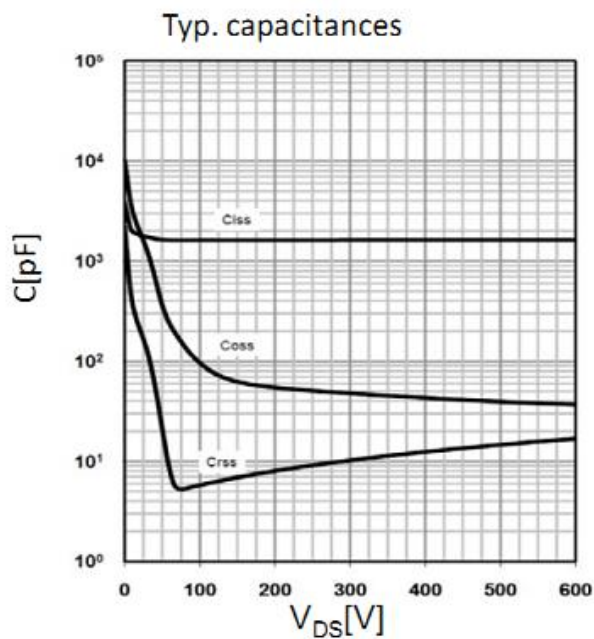


$E_{AS} = f(T_j); I_D = 3.5 A; V_{DD} = 50 V$

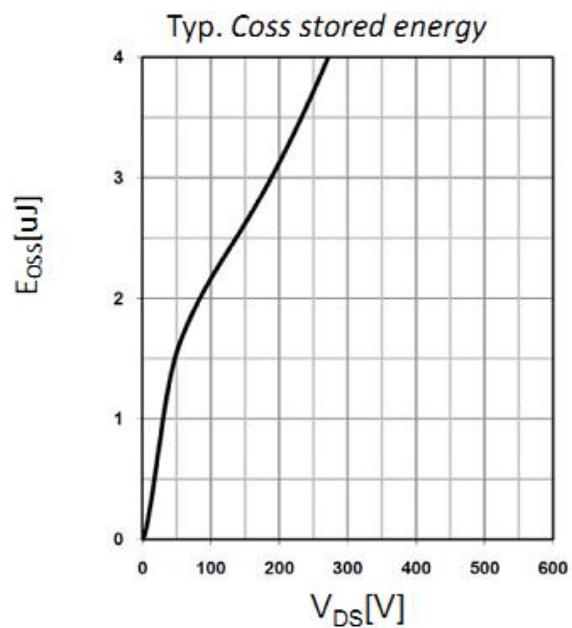
Drain-source breakdown voltage



$V_{BR(DSS)} = f(T_j); I_D = 1.0 mA$

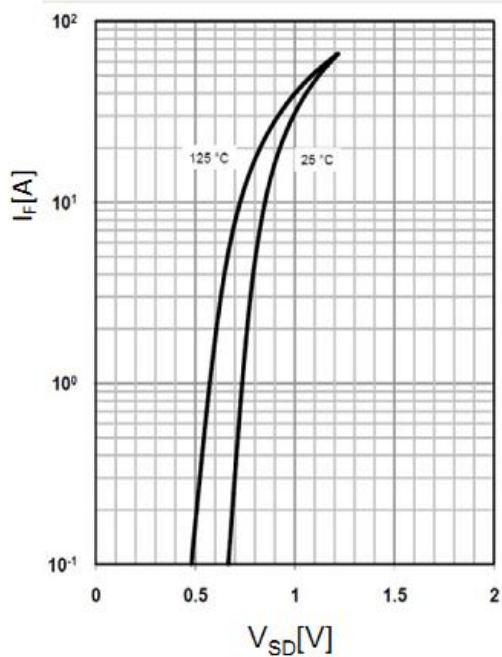


$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$



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

Forward characteristics of reverse diode

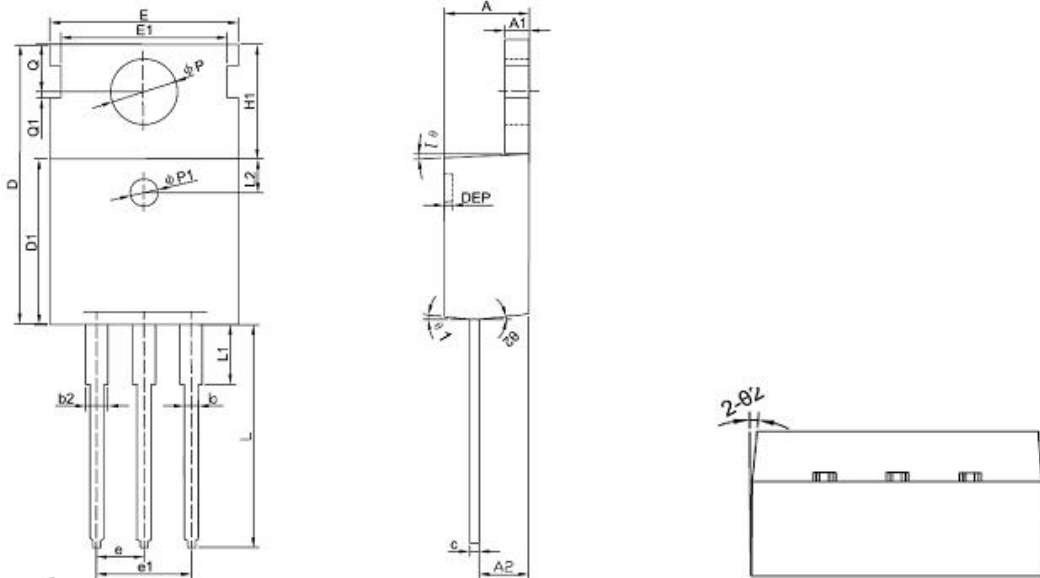


$I_F=f(V_{SD}); \text{parameter: } T_j$

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Package Outline Dimension

TO-220

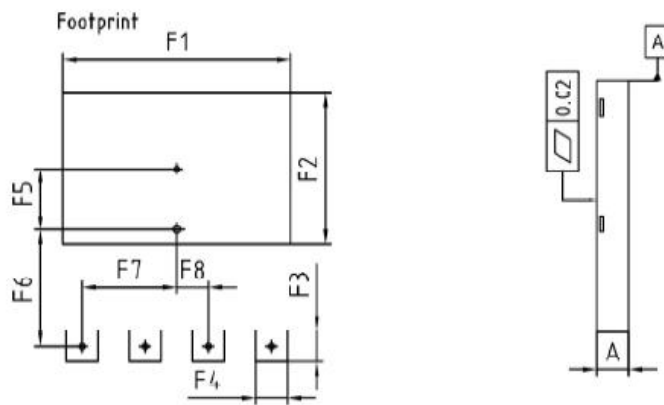
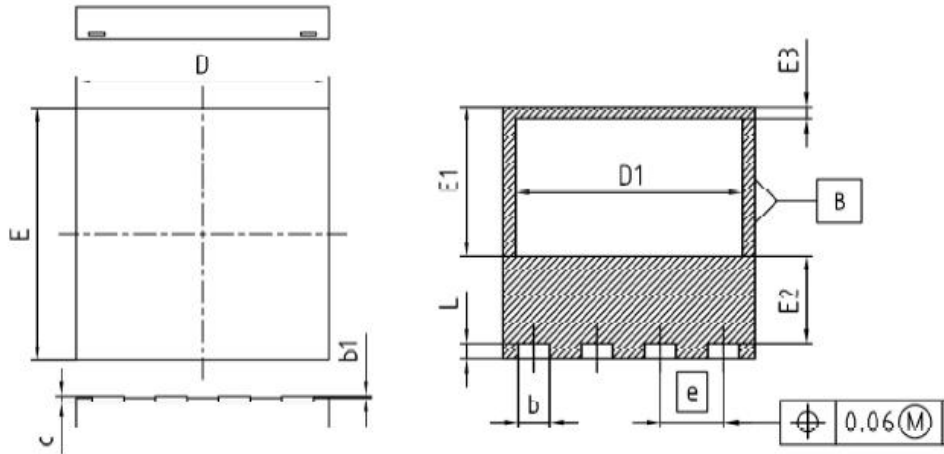


Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	4.400	4.550	4.700	0.173	0.179	0.185
A1	1.270	1.300	1.330	0.050	0.051	0.052
A2	2.590	2.690	2.790	0.102	0.106	0.110
b	0.770	-	0.900	0.030	-	0.035
b2	1.230	-	1.360	0.048	-	0.054
c	0.480	0.500	0.520	0.019	0.020	0.020
D	15.100	15.400	15.700	-	0.606	-
D1	9.000	9.100	9.200	0.354	0.358	0.362
DEP	0.050	0.285	0.520	0.002	0.011	0.020
E	10.060	10.160	10.260	0.396	0.400	0.404
E1	-	8.700	-	-	0.343	-
ΦP1	1.400	1.500	1.600	0.055	0.059	0.063
e	2.54BSC			0.1BSC		
e1	5.08BSC			0.2BSC		
H1	6.100	6.300	6.500	0.240	0.248	0.256
L	12.750	12.960	13.170	0.502	0.510	0.519
L1	-	-	3.950	-	-	0.156
L2	1.85REF			0.073REF		
ΦP	3.570	3.600	3.630	0.141	0.142	0.143
Q	2.730	2.800	2.870	0.107	0.110	0.113
Q1	-	0.200	-	-	0.008	-
θ1	5 ⁰	7 ⁰	9 ⁰	5 ⁰	7 ⁰	9 ⁰
θ2	1 ⁰	3 ⁰	5 ⁰	1 ⁰	3 ⁰	5 ⁰

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Package Outline Dimension

DFN8x8



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
b	0.90	1.10	0.035	0.043
L1	0.00	0.05	0.000	0.002
c	0.10	0.30	0.004	0.012
D	7.90	8.10	0.311	0.319
D1	7.10	7.30	0.280	0.287
E	7.90	8.10	0.311	0.319
E1	4.85	4.85	0.183	0.191
E2	2.05	2.05	0.104	0.112
E3	0.30	0.60	0.012	0.020
e	2.00 (BSC)		0.079 (BSC)	
L	0.40	0.60	0.016	0.024
N	4		4	
F1	7.20		0.283	
F2	4.75		0.107	
F3	1.00		0.039	
F4	1.00		0.039	
F5	1.43		0.056	
F6	4.20		0.165	
F7	3.00		0.118	
F8	1.00		0.039	

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SCALE

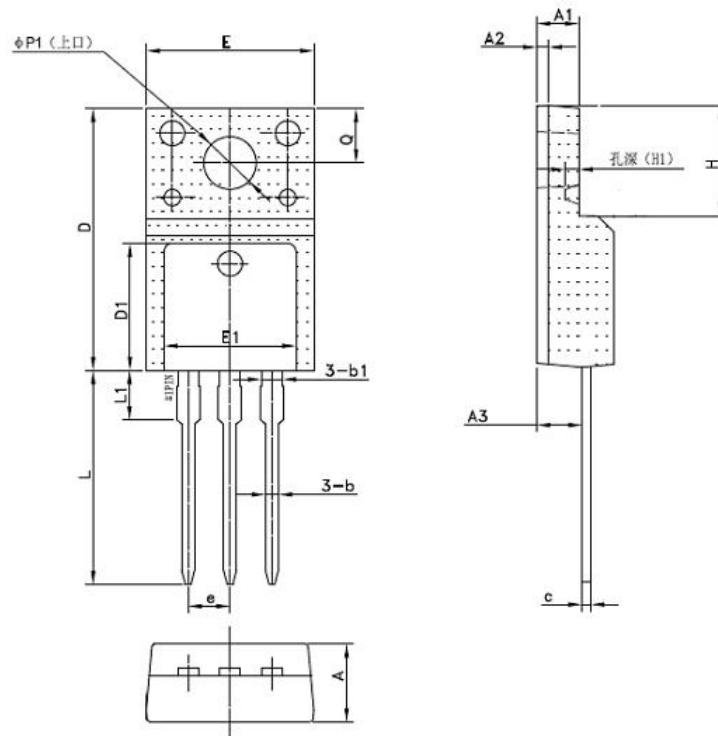
EUROPEAN PROJECTION

ISSUE DATE
05-04-2010

REVISION
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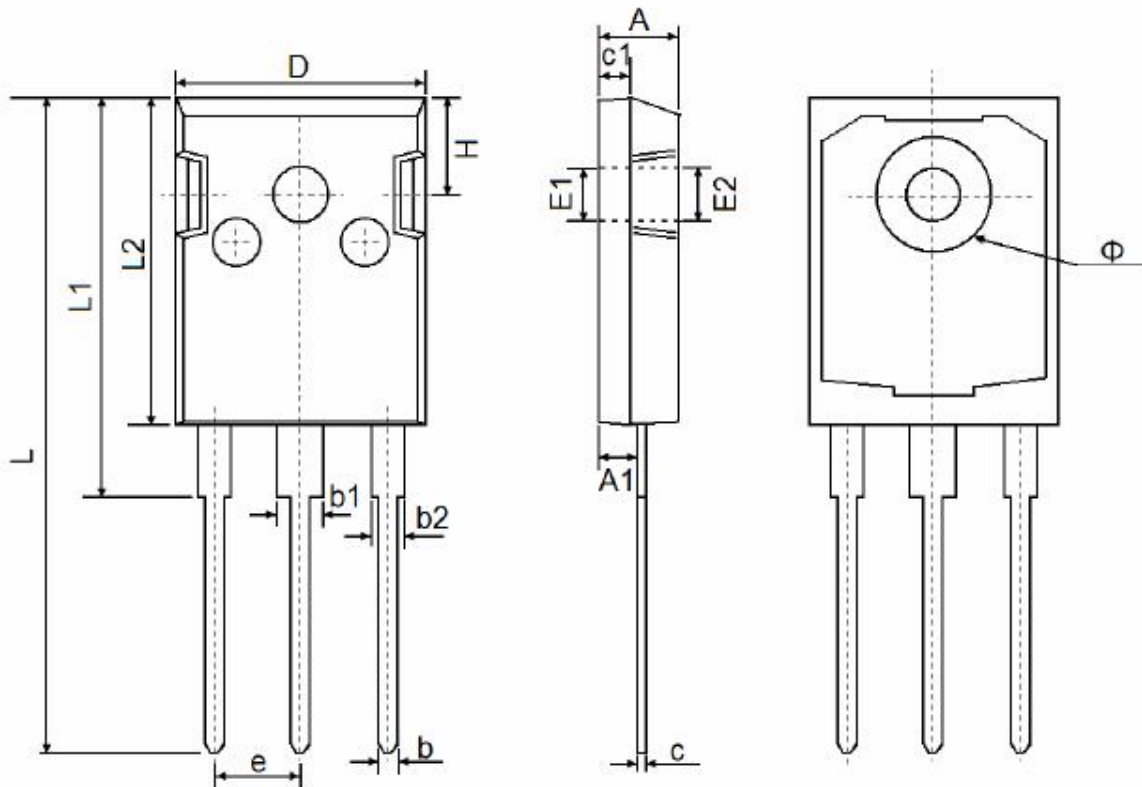
TO-220F



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.44	2.54	2.64
A2	0.60	0.70	0.80
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54(BSC)		
H	6.50	6.70	6.90
(H1)	-	(0.81)	-
L	12.48	12.98	13.20
L1	-	2.93	-
$\phi P1$	2.98	3.18	3.38
Q	3.10	3.30	3.50

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Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		0.138 REF	
E2	3.600 REF		0.142 REF	
L	40.900	41.300	1.610	1.626
L1	24.800	25.100	0.976	0.988
L2	20.300	20.600	0.799	0.811
Φ	7.100	7.300	0.280	0.287
e	5.450 TYP		0.215 TYP	
H	5.980 REF		0.235 REF	

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