SHANGHAI SINO-IC
MICROELECTRONICS CO., LTD.

Apr 2015

SE20NS65F
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
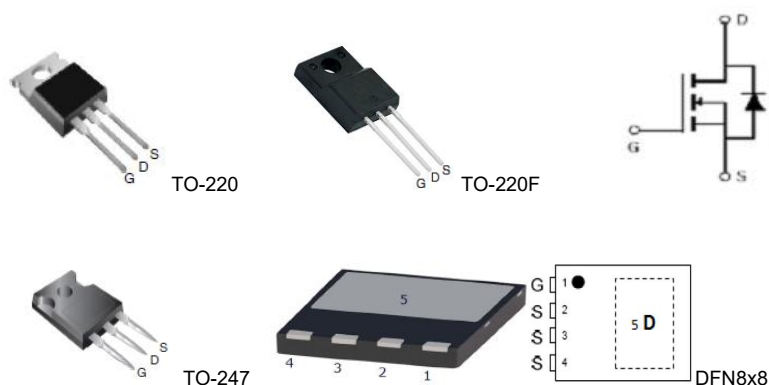- Small Package Outline
- Surface Mount Device

Features

For a single MOSFET

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

Pin configurations

See Diagram below

TO-220   TO-220F

TO-247   DFN8x8

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℃	P_D	208	W
Operating Junction Temperature Range		T_J	-55 to 150	℃

Thermal Resistance

Symbol	Parameter	Min	Typ	Units
$R_{θJC}$	Junction to Case		0.6	℃/W
$R_{θJA}$	Junction to Ambient (t ≦ 10s)		62	℃/W

Electrical Characteristics (TJ=25℃ unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS (Note 2)						
BV_{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,IS=20A dI_F/dt=100A/µs		500		ns
Q_{RR}	Reverse Recovery Charge			6		µC

Test Circuits and Waveform

Switching times test circuit for inductive load

Switching time waveform

Unclamped inductive load test circuit
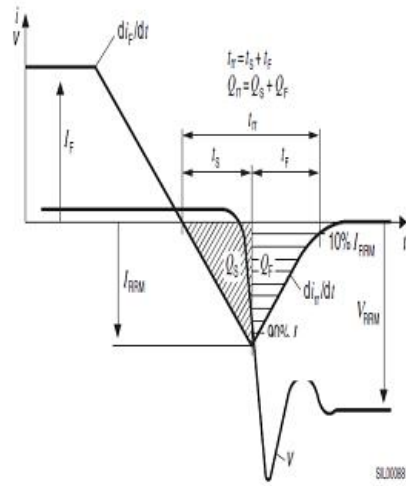
Unclamped inductive waveform
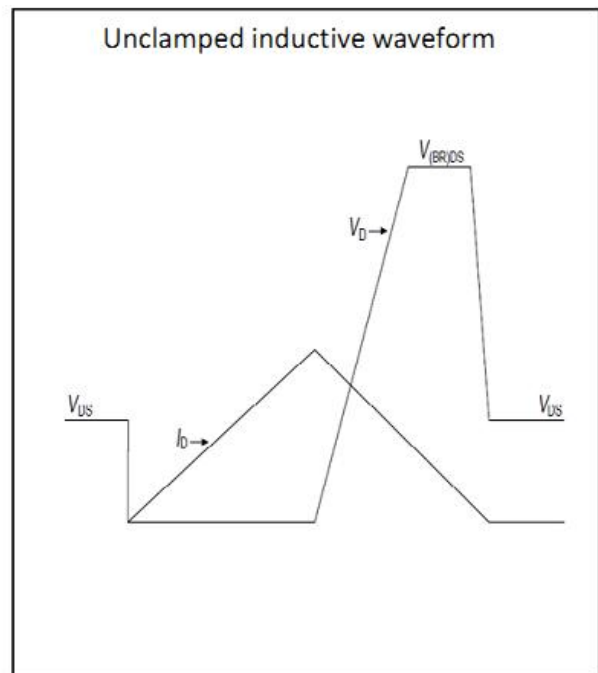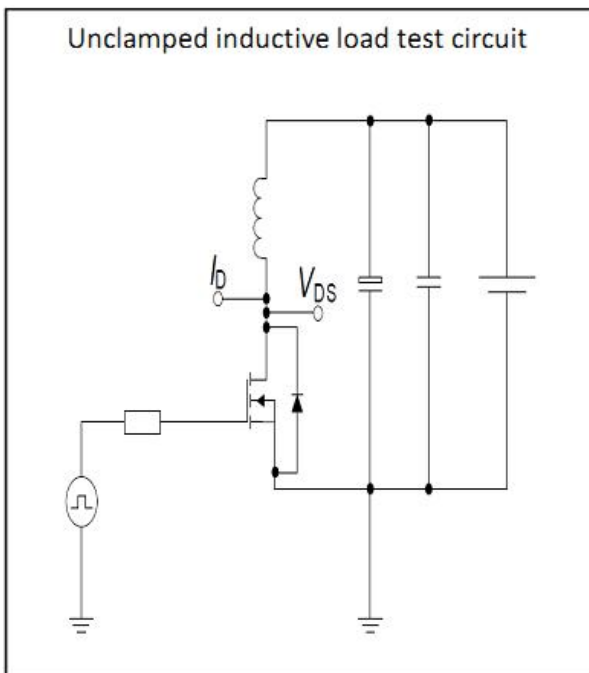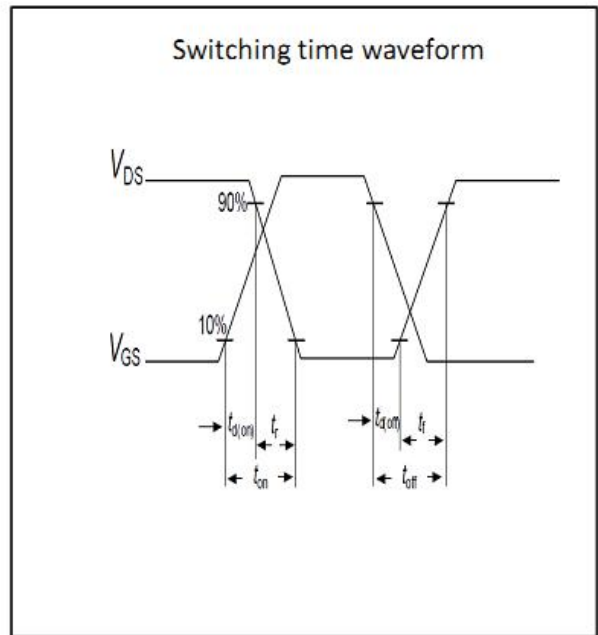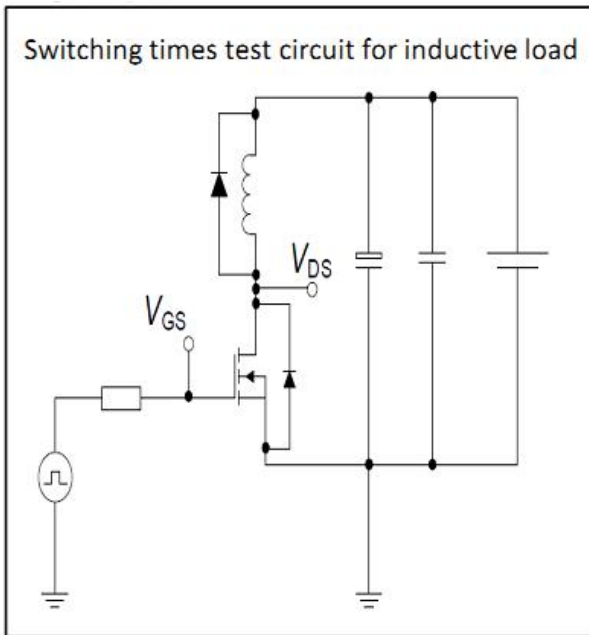
Test Circuits and Waveform

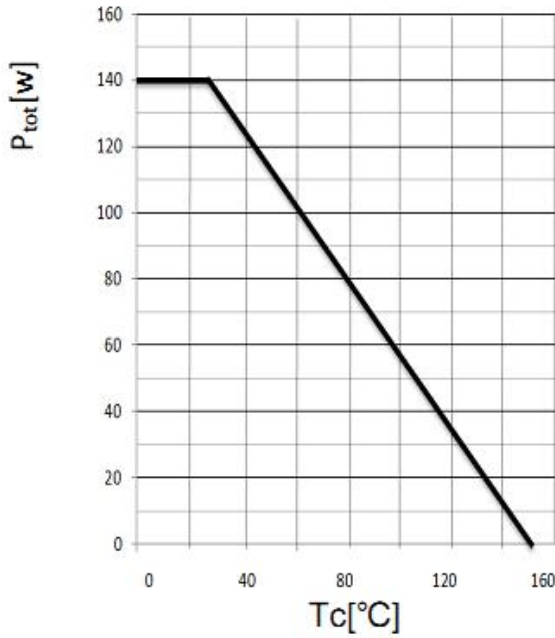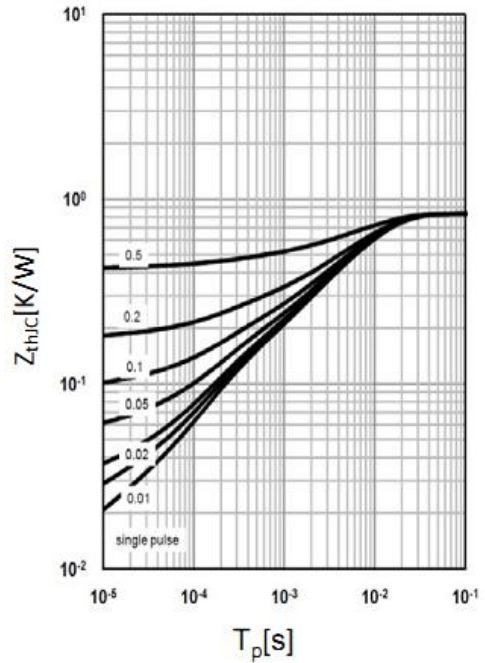Test circuit for diode characteristics
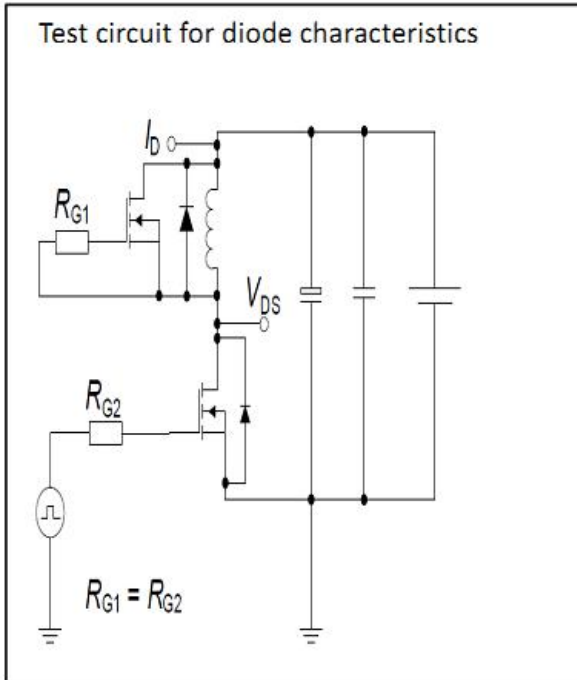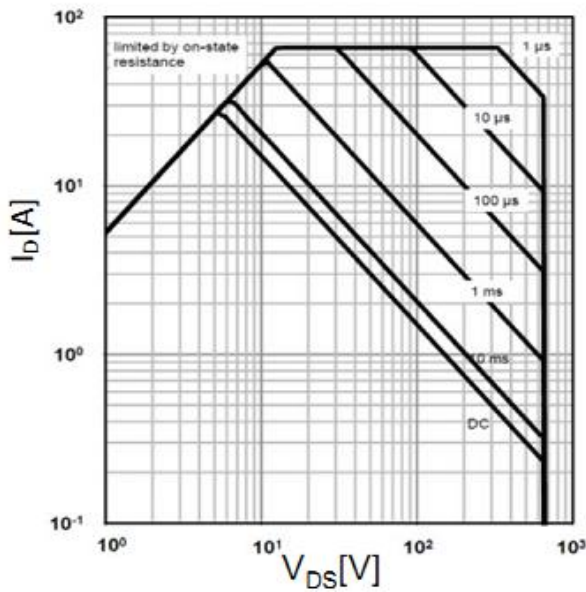

Diode recovery waveform

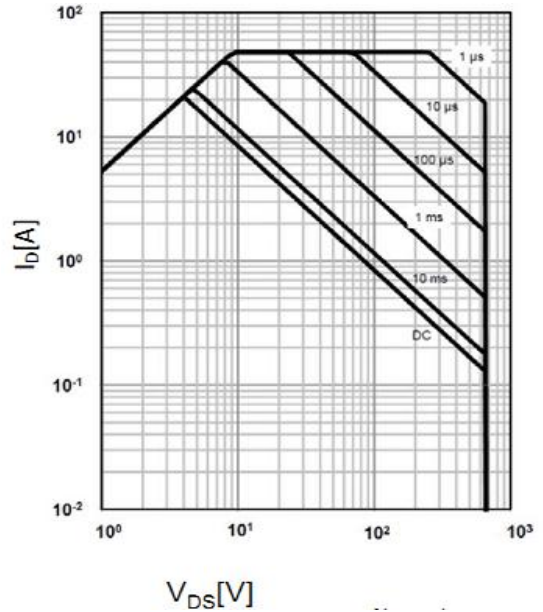**Typical Characteristics**

Power dissipation
TO-220P

Max. transient thermal impedance
TO-220P

Safe operation area TC=25℃

Safe operation area TC=80℃
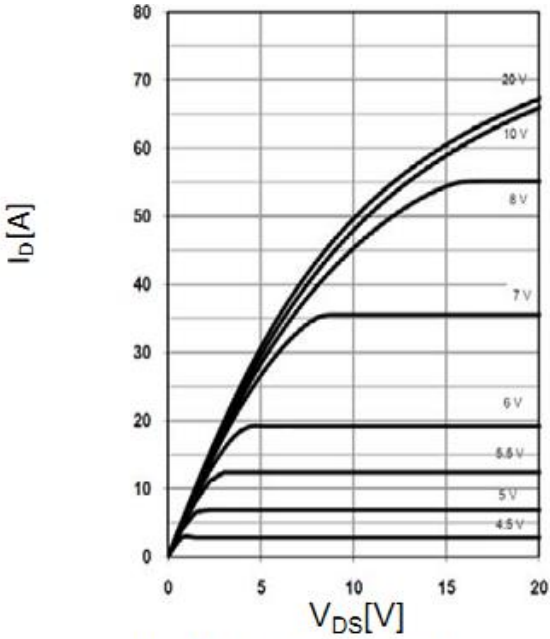
Output characteriscts at TC=25℃
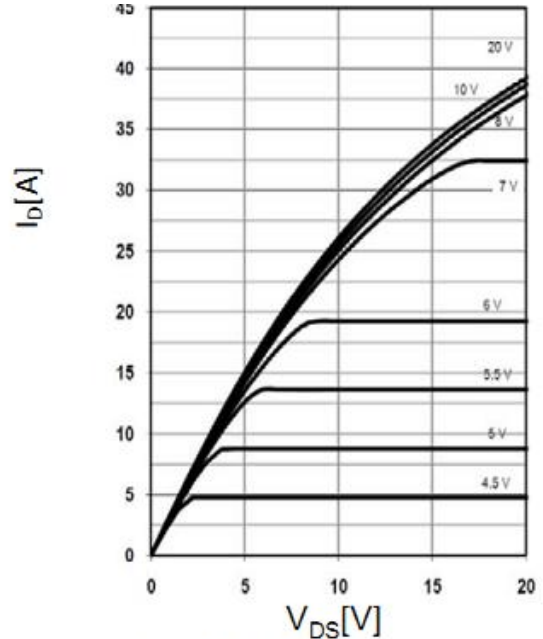

$I_D=f(V_{DS})$; $T_j=25$ ℃ ; parameter: V_{GS}

Output characteriscts at TC=125℃

$I_D=f(V_{DS})$; $T_j=125$ ℃ ; parameter: V_{GS}

Typ. drain-source on-state resistance

$R_{DS}(on)=f(I_D)$; $T_j=125$ ℃ ; parameter: V_{GS}

Typ. drain-source on-state resistance
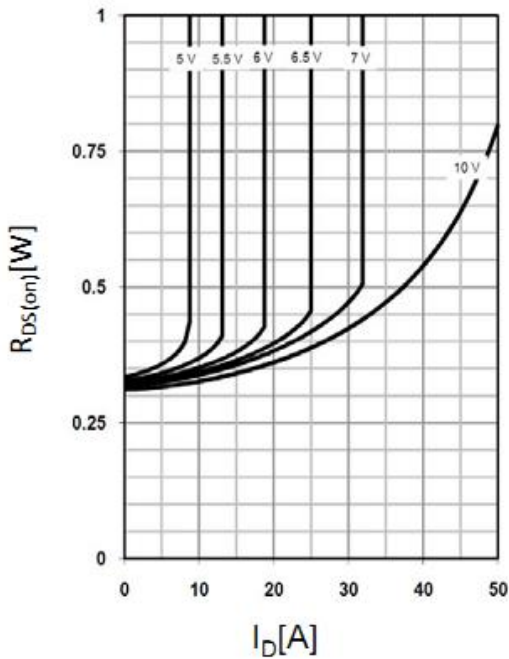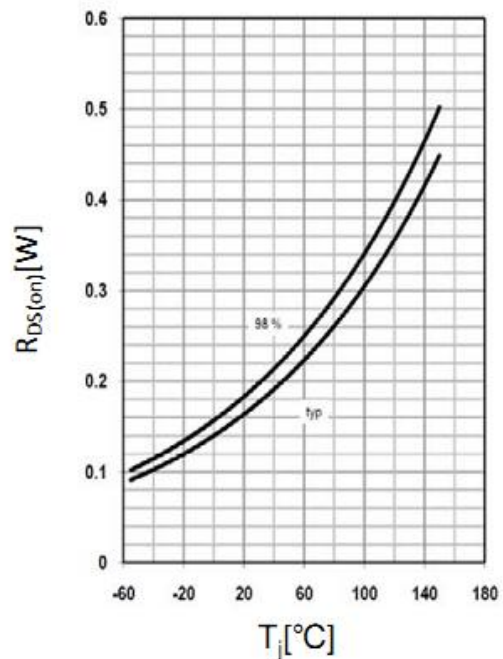
$R_{DS}(on)=f(T_j)$; $I_D=7.3$ A; $V_{GS}=10$ V

Typ. transfer characteristics
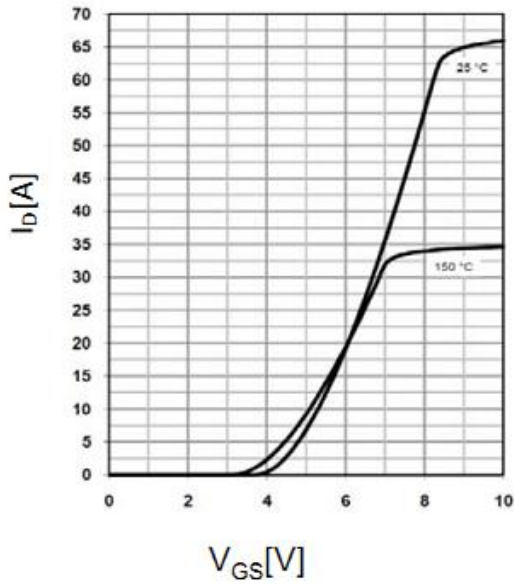
$I_D = f(V_{GS})$; $V_{DS} = 20V$

Typ. gate charge
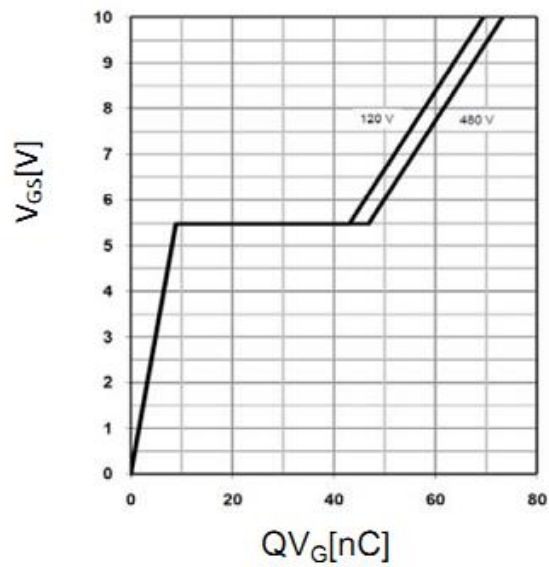
$V_{GS} = f(Q_g)$, $I_D = 11$ A pulsed

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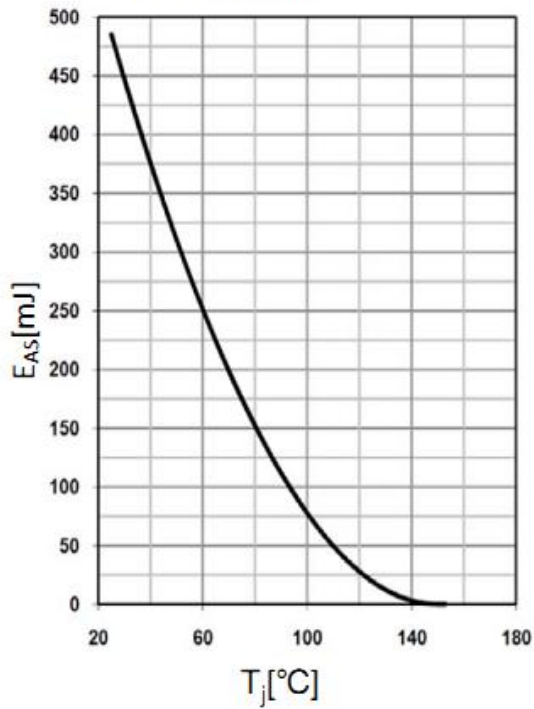
$E_{AS} = f(T_j)$; $I_D = 3.5$ A; $V_{DD} = 50$ V

Drain-source breakdown voltage

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

Typ. capacitances

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

Typ. Coss stored energy
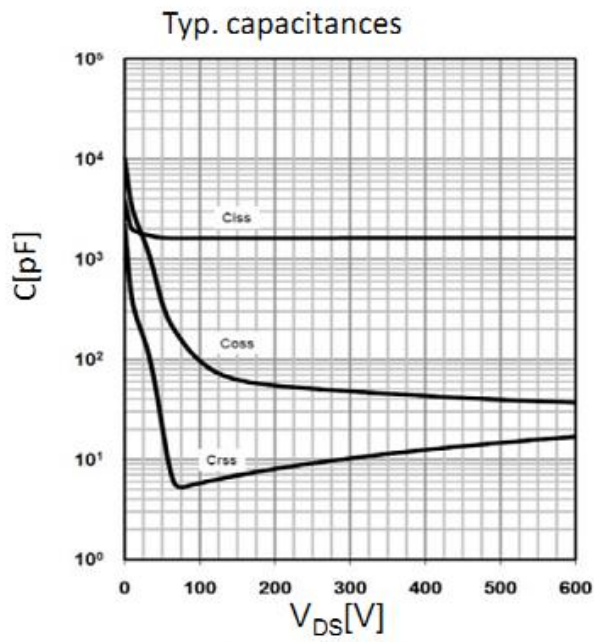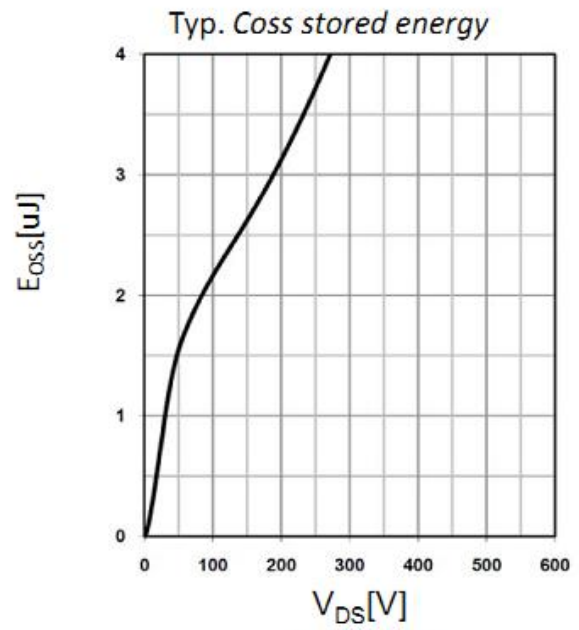
$E_{OSS}=f(V_{DS})$

Forward characteristics of reverse diode

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

Package Outline Dimension

TO-220

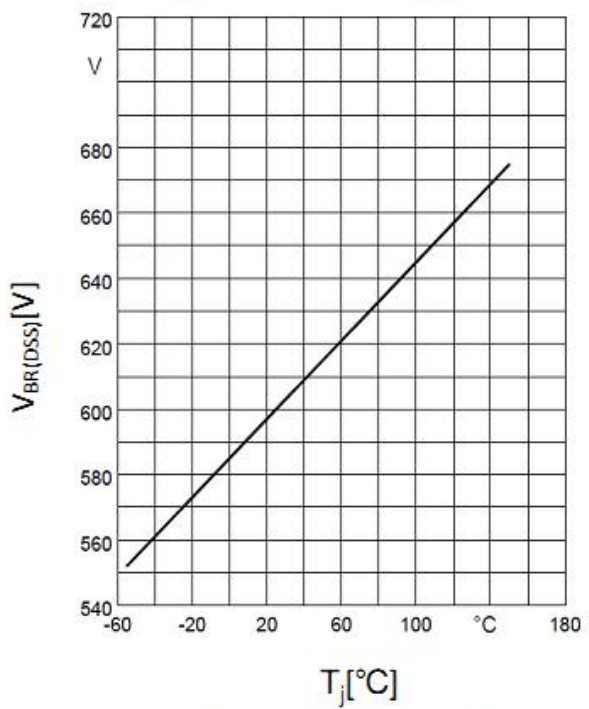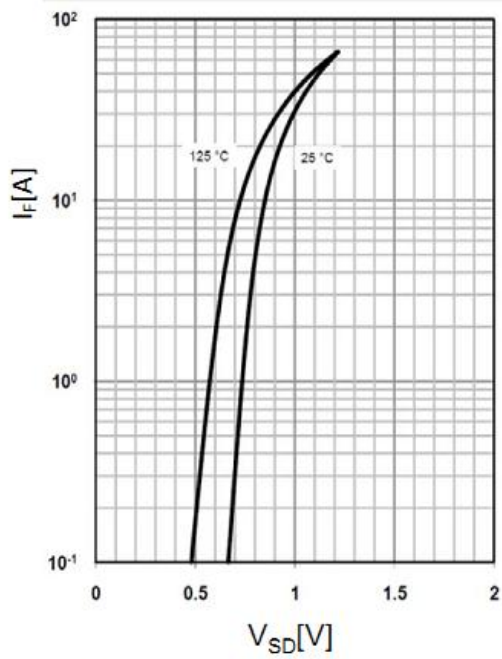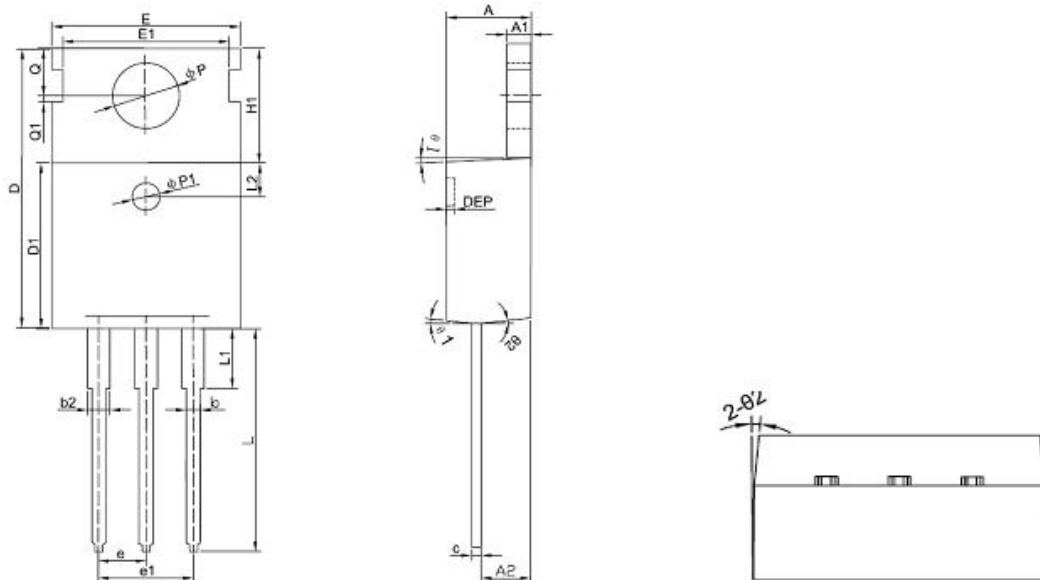| Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	4.400	4.550	4.700	0.173	0.179	0.185
A1	1.270	1.300	1.330	0.050	0.051	0.052
A2	2.590	2.690	2.790	0.102	0.106	0.110
b	0.770	-	0.900	0.030	-	0.035
b2	1.230	-	1.360	0.048	-	0.054
c	0.480	0.500	0.520	0.019	0.020	0.020
D	15.100	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

Package Outline Dimension

DFN8x8
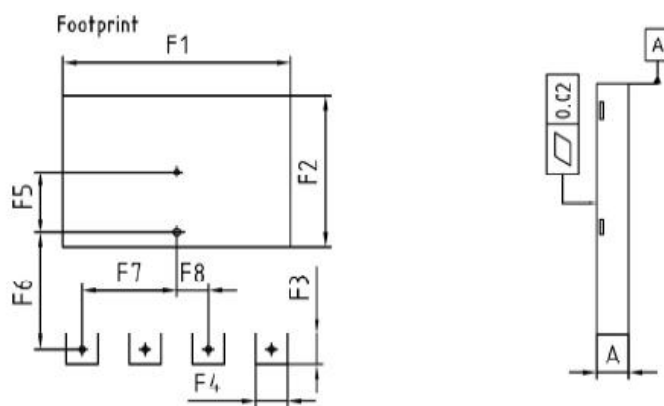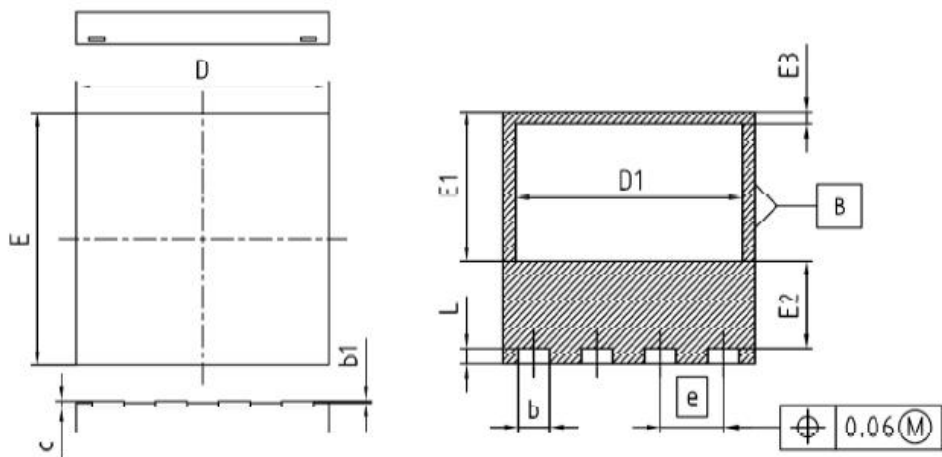
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
b	0.90	1.10	0.035	0.043
b1	0.00	0.05	0.000	0.002
c	0.10	0.30	0.004	0.012
D	7.90	8.10	0.311	0.319
D1	7.10	7.30	0.280	0.287
E	7.90	8.10	0.311	0.319
E1	4.65	4.85	0.183	0.191
E2	2.65	2.85	0.104	0.112
E3	0.30	0.50	0.012	0.020
e	2.00 (BSC)		0.079 (BSC)	
L	0.40	0.60	0.016	0.024
N	4		4	
F1	7.20		0.283	
F2	4.75		0.187	
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
01

TO-220F
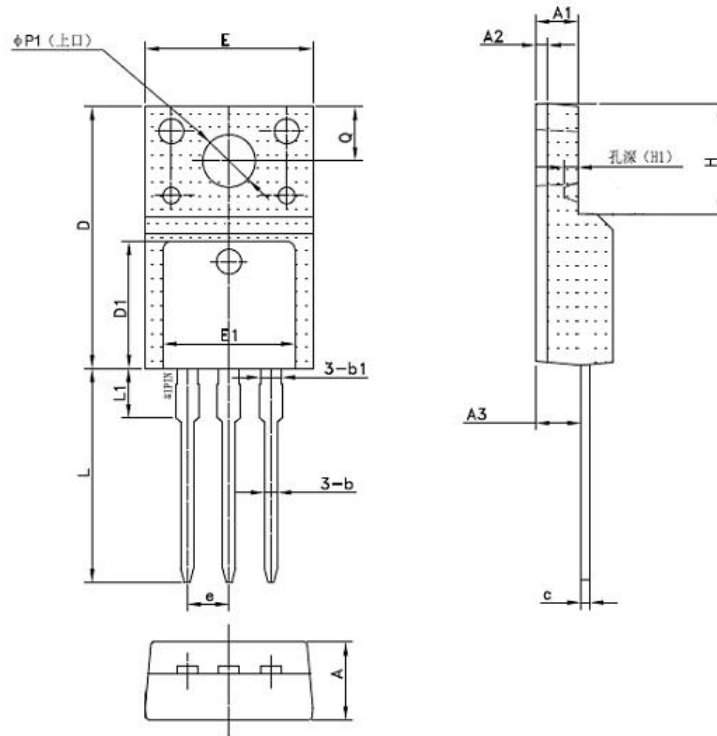
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.44	2.54	2.64
A2	0.60	0.70	0.80
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54(BSC)		
H	6.50	6.70	6.90
(H1)	-	(0.81)	-
L	12.48	12.98	13.20
L1	-	2.93	-
ΦP1	2.98	3.18	3.38
Q	3.10	3.30	3.50

TO-247
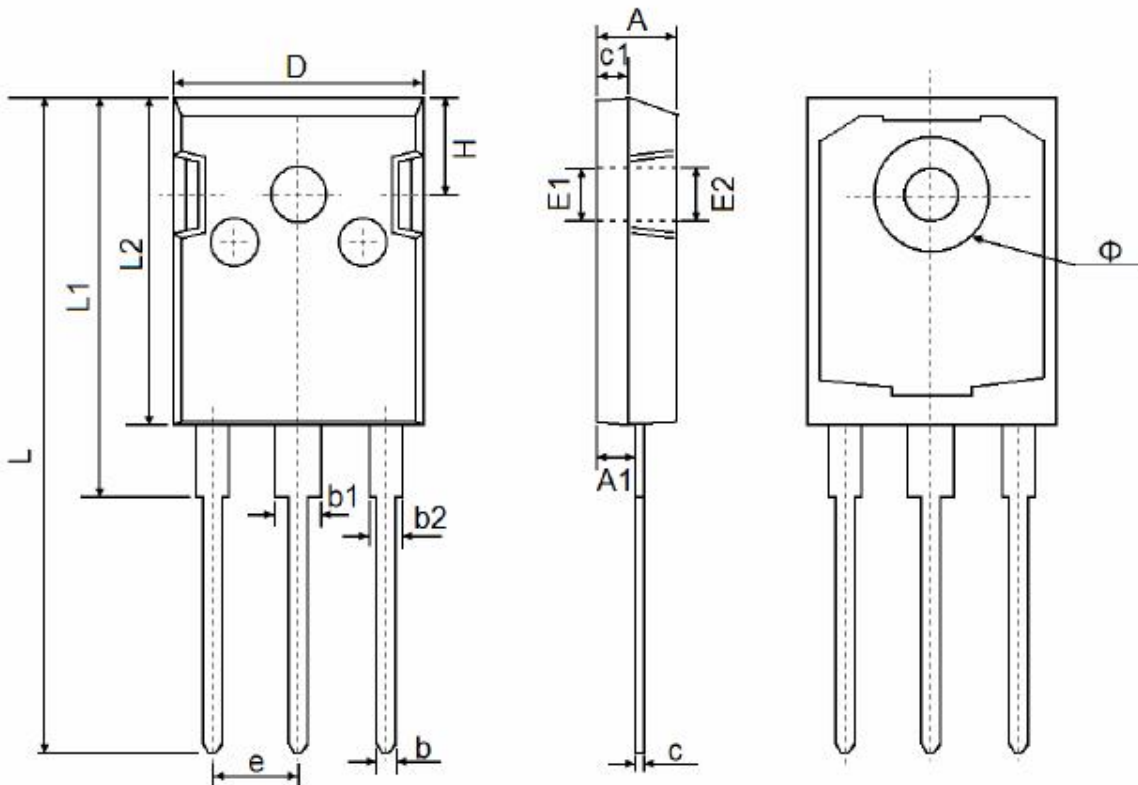
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		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	