

Semiconductor Co., Ltd.

SE20NS60

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

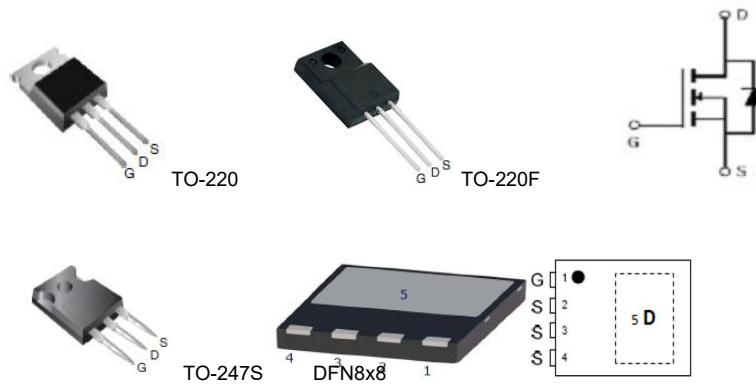
Features

For a single MOSFET

- $V_{DS} = 600V$
- $R_{DS(ON)} = 160m\Omega @ V_{GS}=10V$

Pin configurations

See Diagram below



Absolute Maximum Ratings

| Parameter | Symbol | Rating | Units |
|--------------------------------------|------------|------------|-------|
| Drain-Source Voltage | V_{DS} | 600 | V |
| Gate-Source Voltage | V_{GS} | ± 30 | V |
| Drain Current | Continuous | 20 | A |
| | Pulsed | 64 | |
| Total Power Dissipation | @TA=25°C | 208 | W |
| Operating Junction Temperature Range | T_J | -55 to 150 | °C |

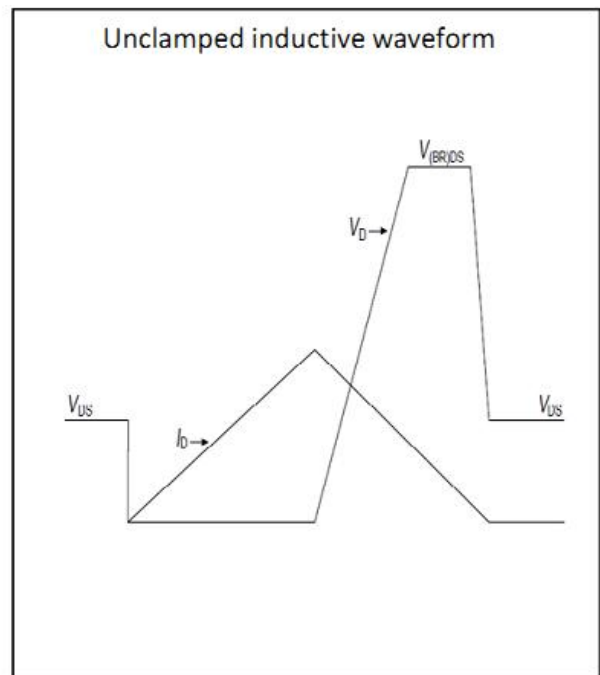
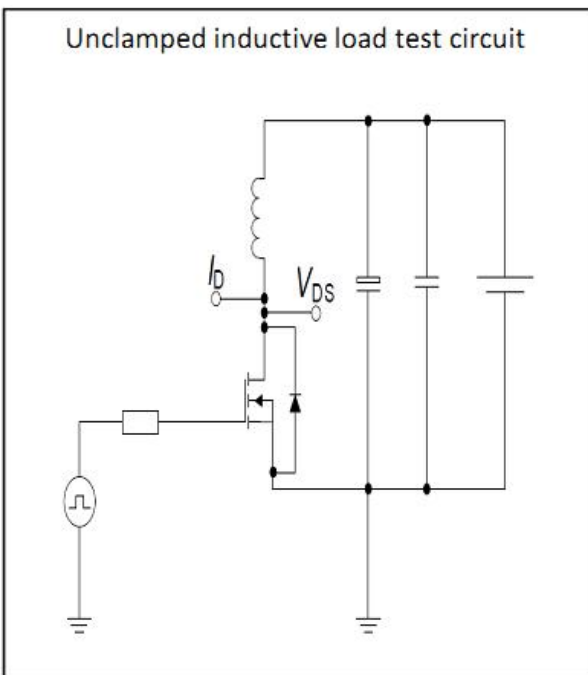
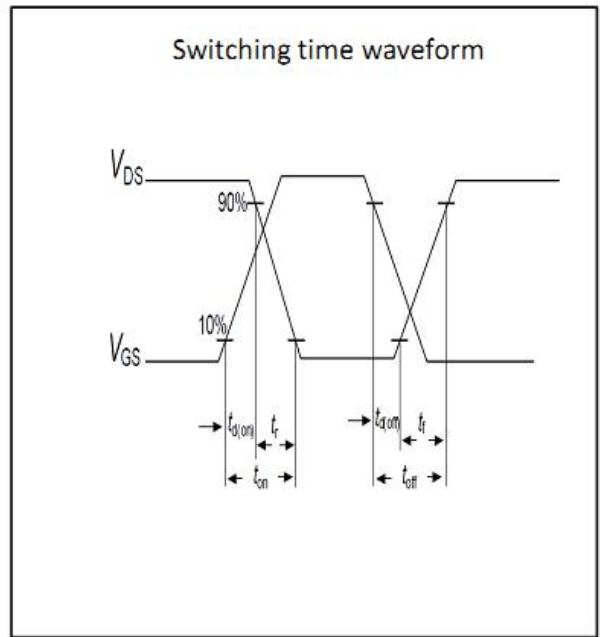
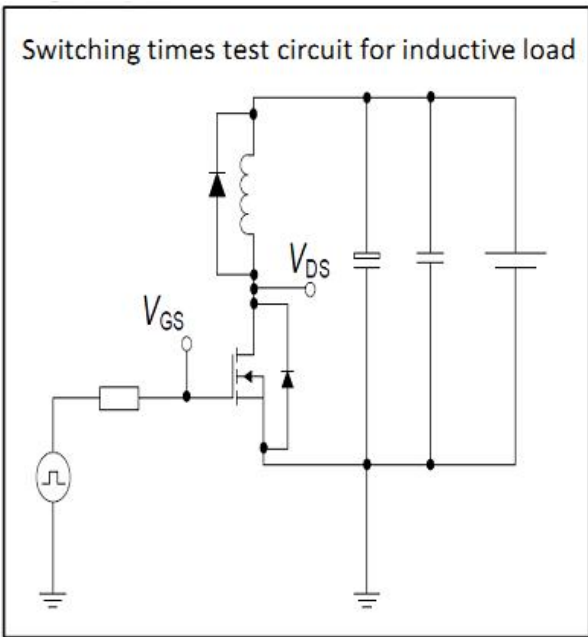
Thermal Resistance

| 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 |

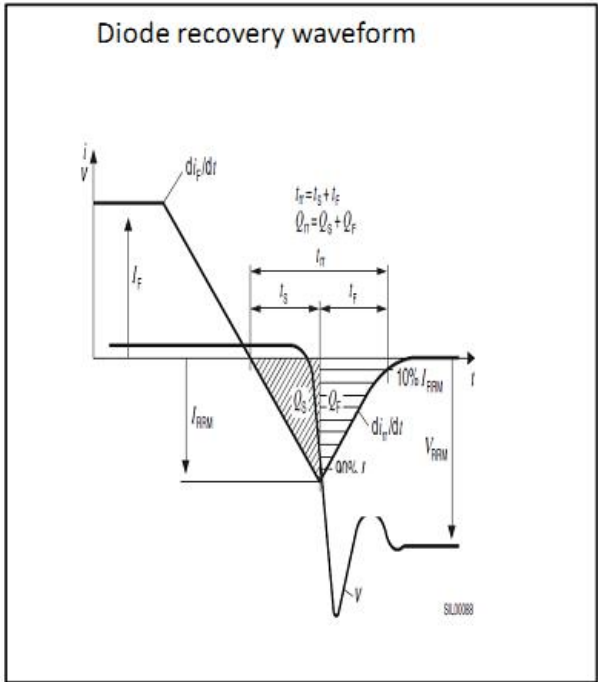
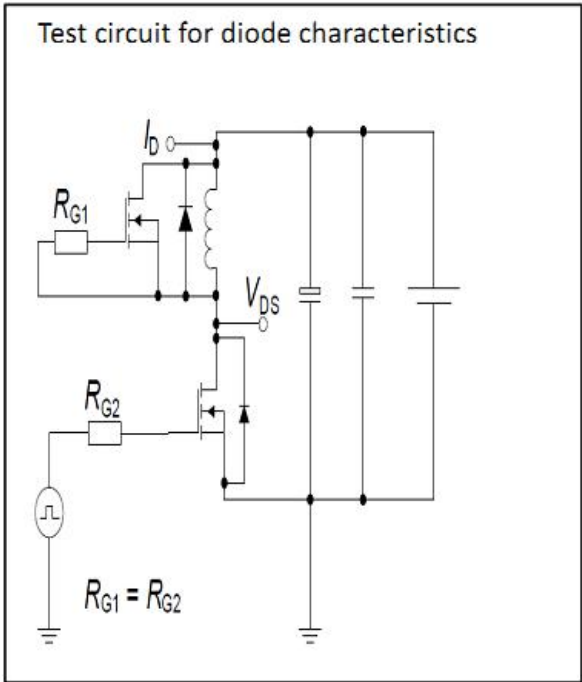
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| Electrical Characteristics (T _J =25°C unless otherwise noted) | | | | | | |
|--|--|---|-----|------|-----|-------|
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
| OFF CHARACTERISTICS (Note 2) | | | | | | |
| B _V DSS | Drain-Source Breakdown Voltage | I _D =250μA, V _{GS} =0 V | 600 | | | V |
| I _{DSS} | Drain to Source Leakage Current | V _{DS} = 600V, 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 =11A | | 0.9 | 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 | V _{GS} =0V, I _S =11A | | 475 | | ns |
| Q _{RR} | Reverse Recovery Charge | di _F /dt=100A/μs | | 5.8 | | μC |

Test Circuits and Waveform



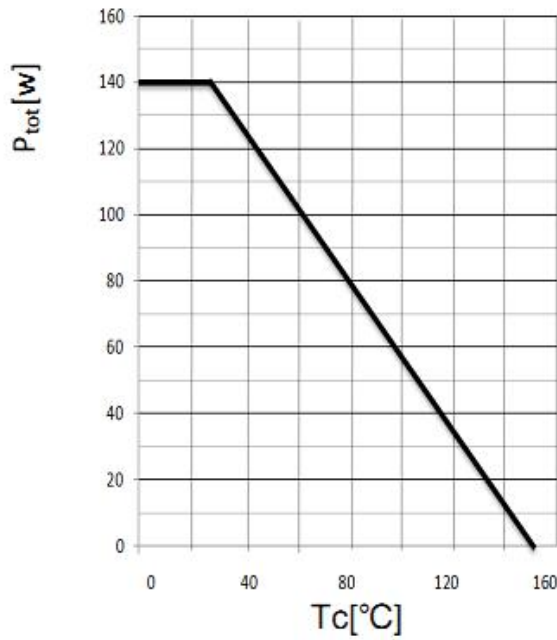
Test Circuits and Waveform



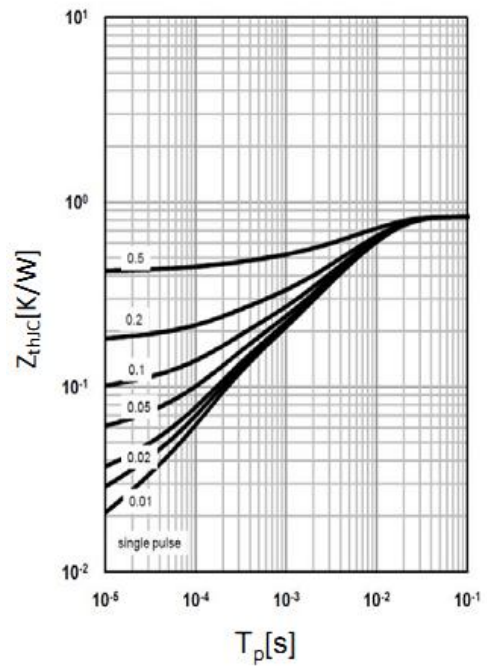
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Typical Characteristics

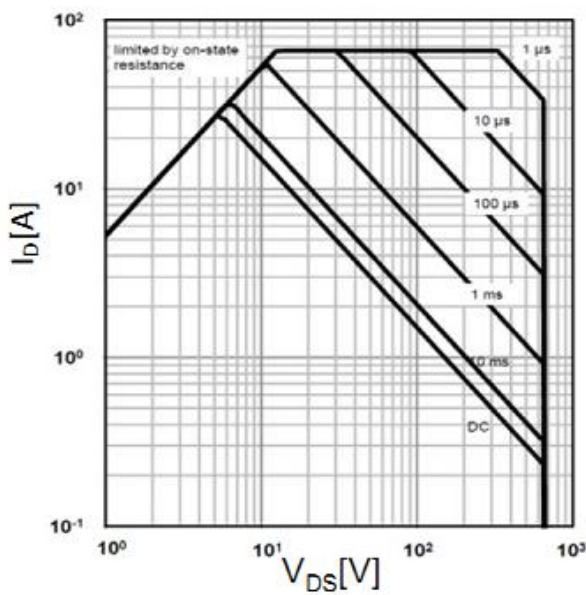
Power dissipation
TO-220P



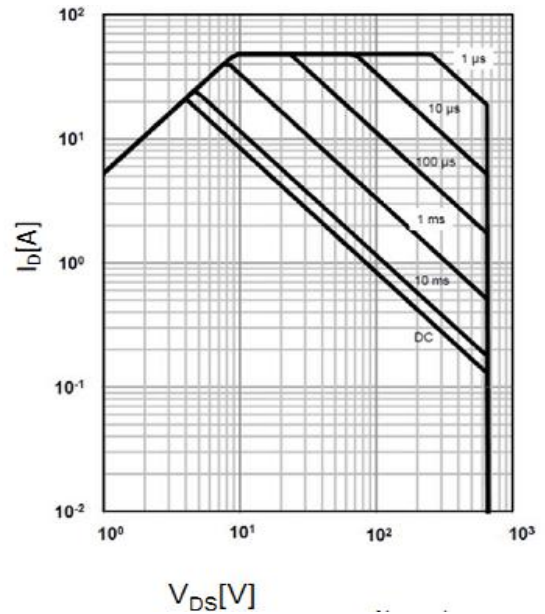
Max. transient thermal impedance
TO-220P



Safe operation area TC=25°C

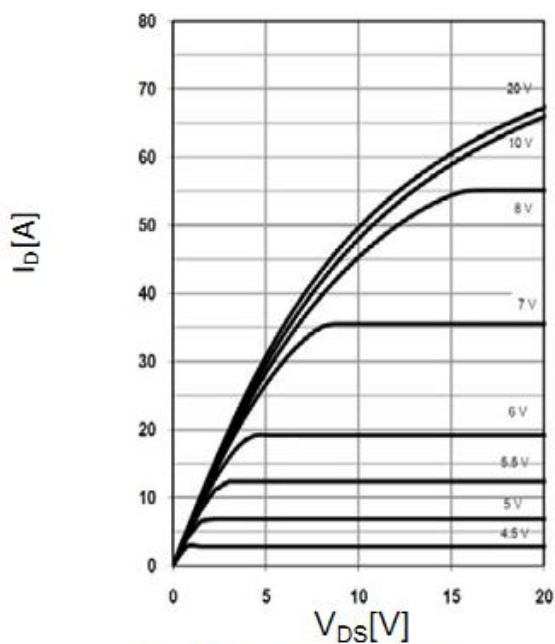


Safe operation area TC=80°C



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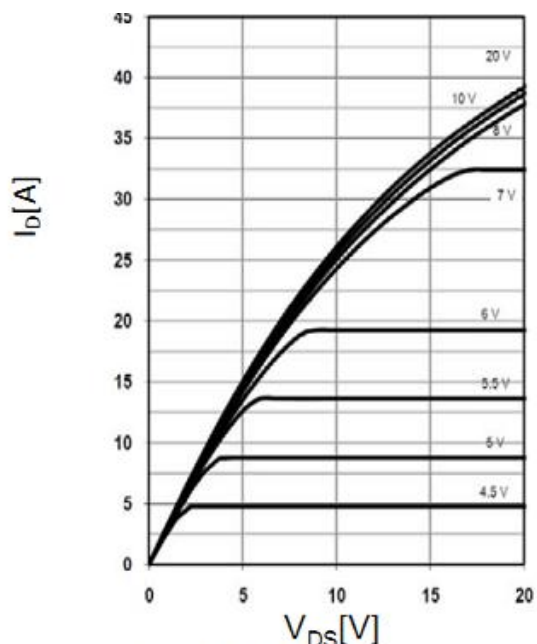
Output characteristics at TC=25°C



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

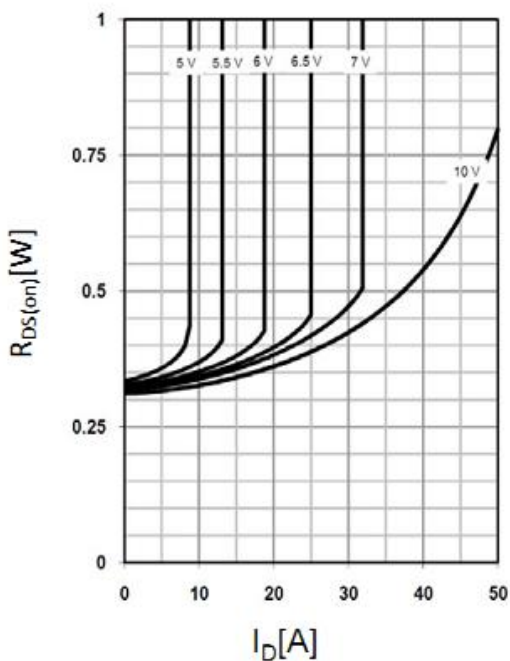
Typ. drain-source on-state resistance

Output characteristics at TC=125°C

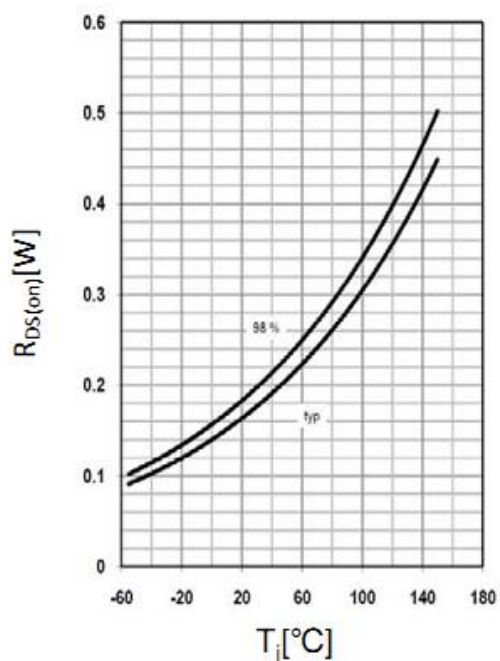


$I_D = f(V_{DS}); T_j = 125\text{ }^\circ\text{C}; \text{ parameter: } V_{GS}$

Typ. drain-source on-state resistance

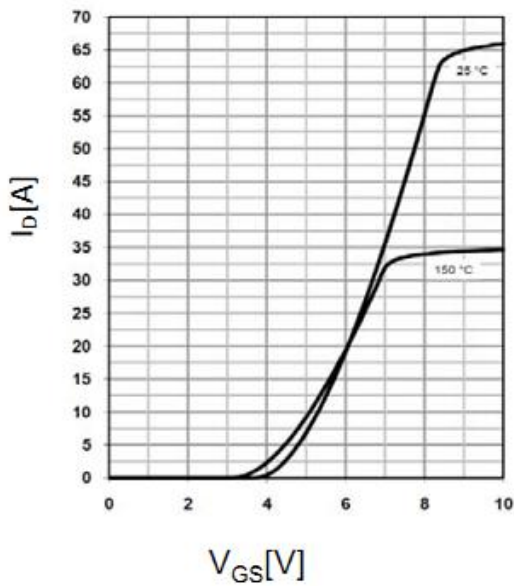


$R_{DS(on)} = f(I_D); T_j = 125\text{ }^\circ\text{C}; \text{ parameter: } V_{GS}$



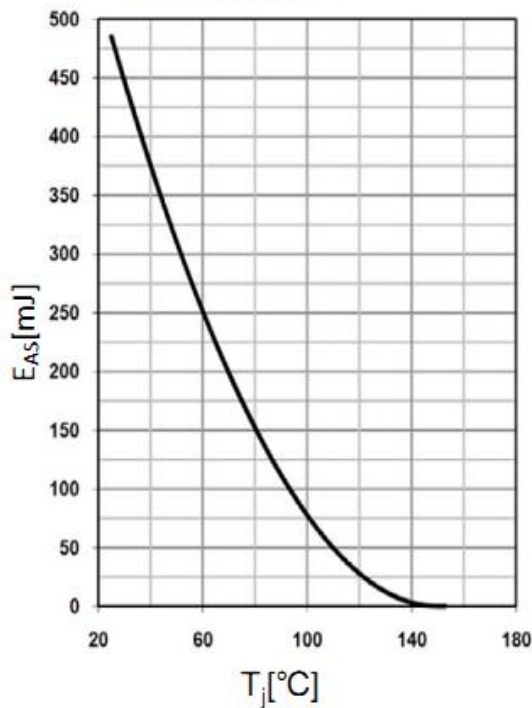
$R_{DS(on)} = f(T_j); I_D = 7.3\text{ A}; V_{GS} = 10\text{ V}$

Typ. transfer characteristics



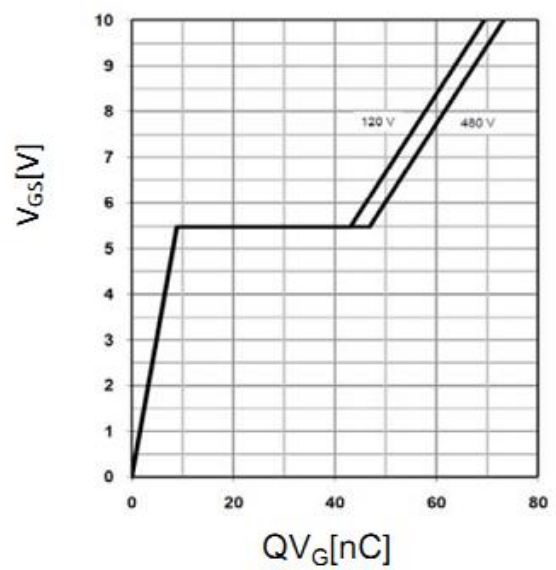
$I_D = f(V_{GS}); V_{DS} = 20V$

Avalanche energy



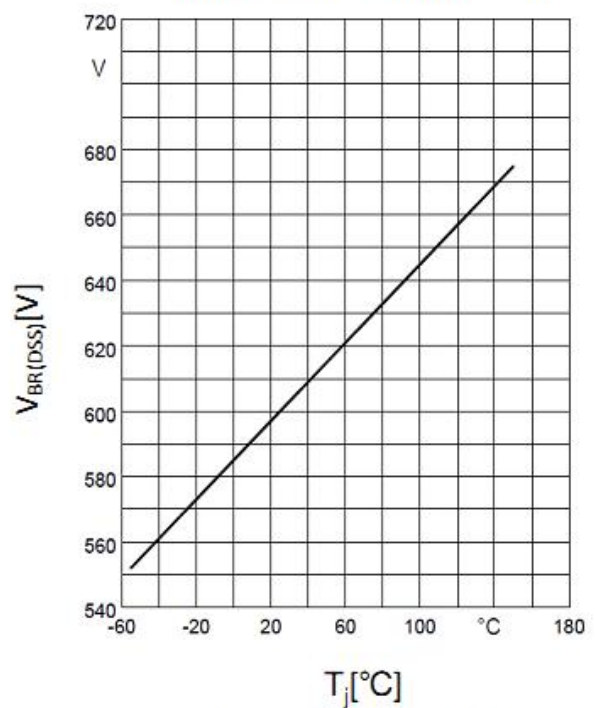
$E_{AS} = f(T_j); I_D = 3.5 A; V_{DD} = 50 V$

Typ. gate charge

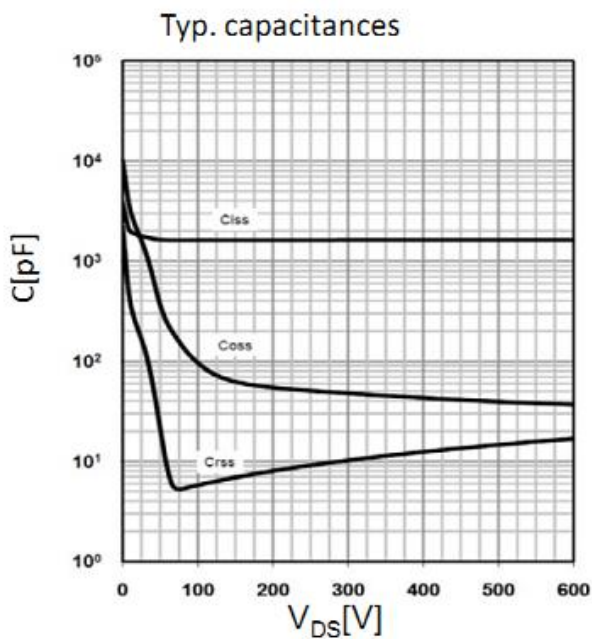


$V_{GS} = f(Q_g), I_D = 11 A$ pulsed

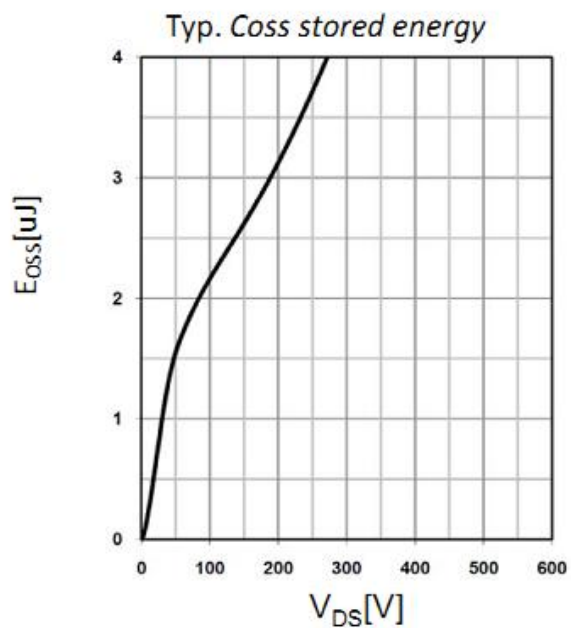
Drain-source breakdown voltage



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

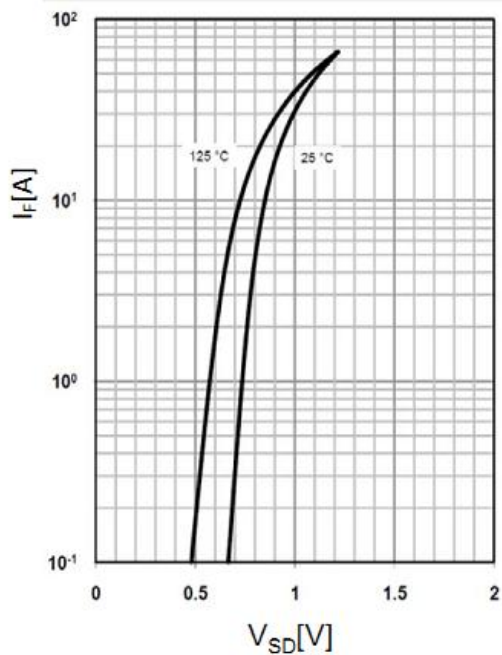


$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



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

Forward characteristics of reverse diode

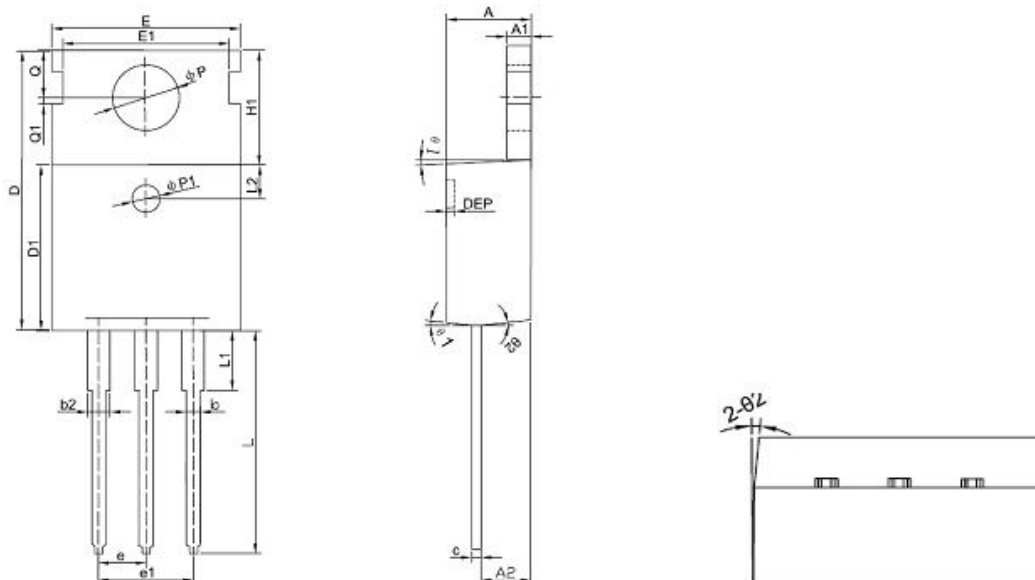


$I_F = f(V_{SD}); \text{parameter: } T_j$

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Package Outline Dimension

TO-220

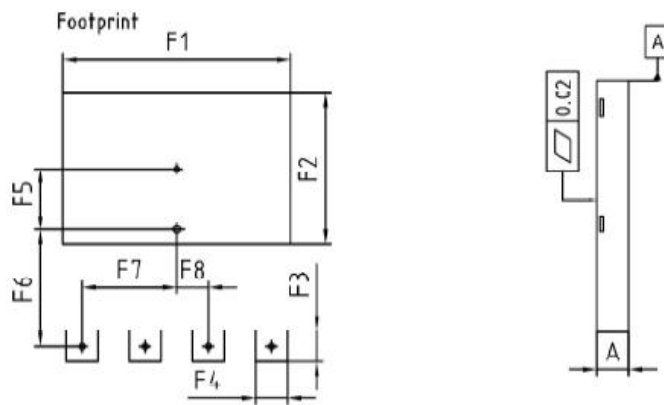
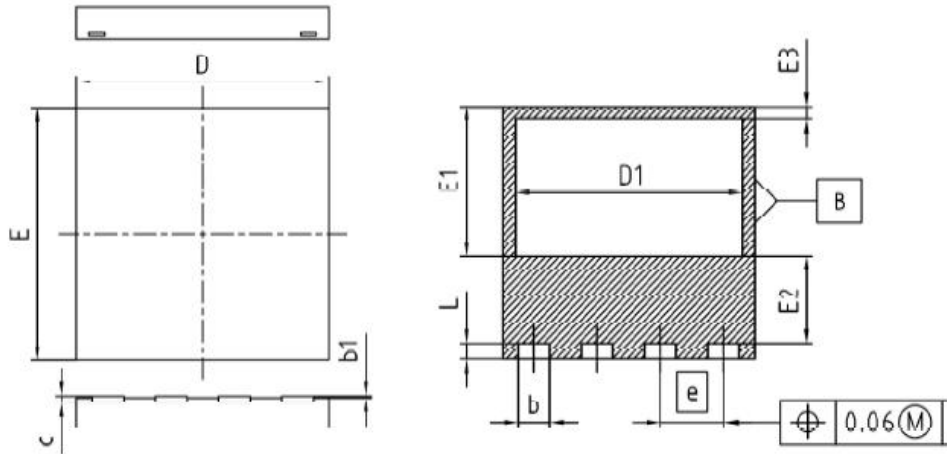


| Symbol | Dimension In Millimeters | | | Dimension In Inches | | |
|--------|--------------------------|----------------|----------------|---------------------|----------------|----------------|
| | Min | Nom | Max | Min | Nom | Max |
| A | 4.400 | 4.550 | 4.700 | 0.173 | 0.179 | 0.185 |
| A1 | 1.270 | 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 |

SE20NS60

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 | |

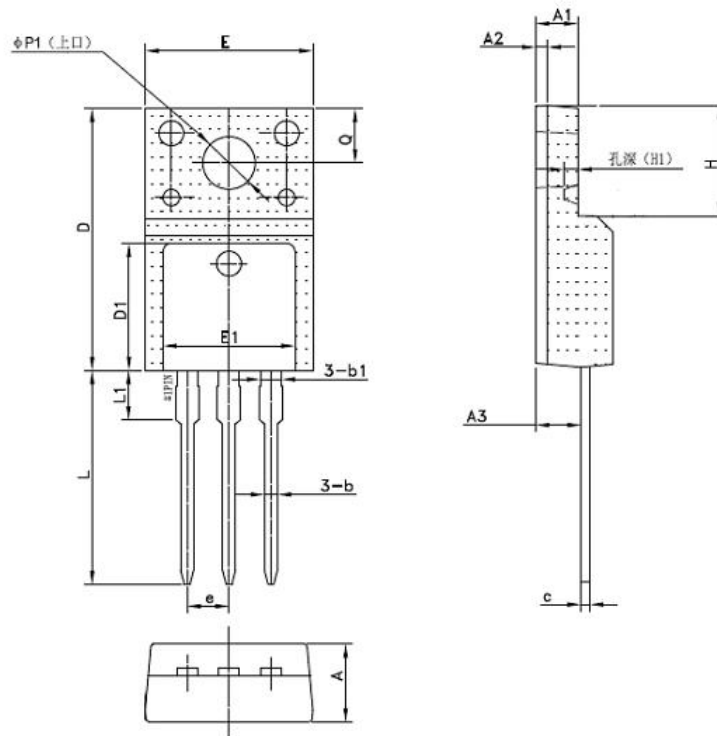
DOCUMENT NO.
Z0B00136707

SCALE

EUROPEAN PROJECTION

ISSUE DATE
05-04-2010

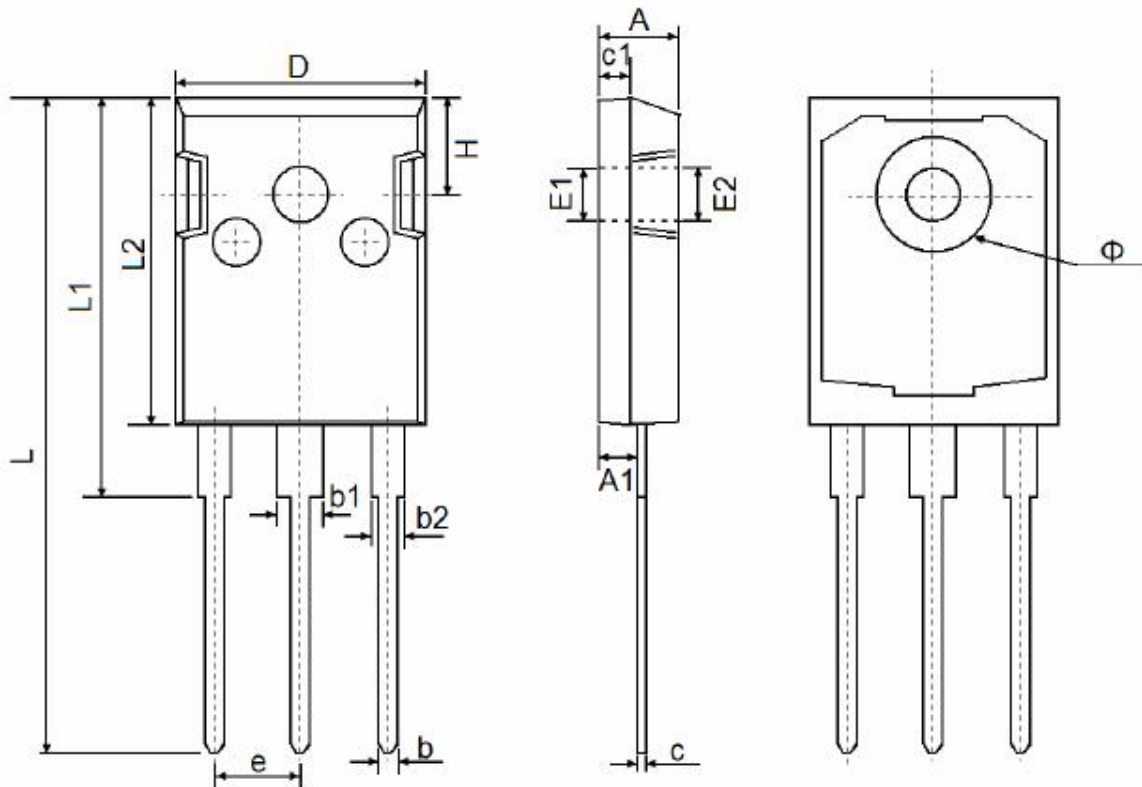
REVISION
01



| 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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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 | |

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