

NCE N-Channel Super Trench Power MOSFET

Description

The NCEP0178A uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g . This device is ideal for high-frequency switching and synchronous rectification.

General Features

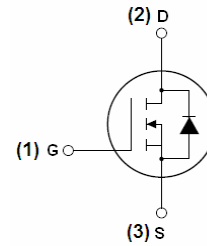
- $V_{DS} = 100V, I_D = 78A$
 $R_{DS(ON)} = 7.2m\Omega$ (typical) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 9.5m\Omega$ (typical) @ $V_{GS} = 4.5V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

100% UIS TESTED!

100% ΔV_{ds} TESTED!



Schematic diagram



Marking and pin assignment



TO-220-3L top view

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|-----------|----------------|-----------|------------|----------|
| NCEP0178A | NCEP0178A | TO-220-3L | - | - | - |

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|--------------------|------------|---------------|
| Drain-Source Voltage | V_{DS} | 100 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Drain Current-Continuous | I_D | 78 | A |
| Drain Current-Continuous($T_C = 100^\circ C$) | $I_D(100^\circ C)$ | 60 | A |
| Pulsed Drain Current | I_{DM} | 320 | A |
| Maximum Power Dissipation | P_D | 125 | W |
| Derating factor | | 0.83 | W/ $^\circ C$ |
| Single pulse avalanche energy ^(Note 5) | E_{AS} | 320 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 175 | $^\circ C$ |

Thermal Characteristic

| | | | |
|--|-----------------|-----|---------------|
| Thermal Resistance, Junction-to-Case ^(Note 2) | $R_{\theta JC}$ | 1.2 | $^{\circ}C/W$ |
|--|-----------------|-----|---------------|

Electrical Characteristics ($T_C=25^{\circ}C$ unless otherwise noted)

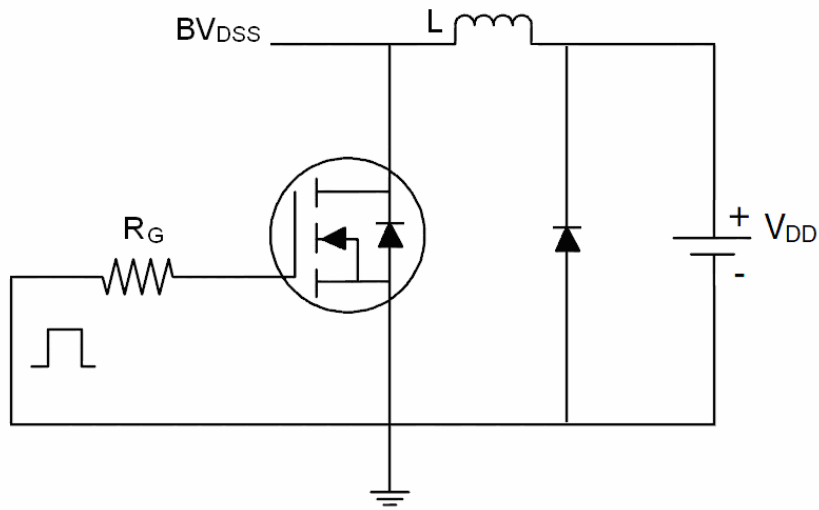
| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|--------------|--|-----|------|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 100 | | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=100V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics ^(Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.2 | 1.7 | 2.2 | V |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=39A$ | - | 7.2 | 8.5 | m Ω |
| | | $V_{GS}=4.5V, I_D=39A$ | - | 9.5 | 12 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=10V, I_D=39A$ | 40 | - | - | S |
| Dynamic Characteristics ^(Note 4) | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$ | - | 4200 | 5480 | PF |
| Output Capacitance | C_{oss} | | - | 354 | 425 | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 23 | 30 | PF |
| Switching Characteristics ^(Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=50V, I_D=39A$ $V_{GS}=10V, R_G=4.7\Omega$ | - | 15 | - | nS |
| Turn-on Rise Time | t_r | | - | 10 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 41 | - | nS |
| Turn-Off Fall Time | t_f | | - | 6 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=50V, I_D=39A,$ $V_{GS}=10V$ | - | 65 | | nC |
| Gate-Source Charge | Q_{gs} | | - | 15.3 | | nC |
| Gate-Drain Charge | Q_{gd} | | - | 9 | | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage ^(Note 3) | V_{SD} | $V_{GS}=0V, I_S=78A$ | - | | 1.2 | V |
| Diode Forward Current ^(Note 2) | I_S | | - | - | 78 | A |
| Reverse Recovery Time | t_{rr} | $T_J = 25^{\circ}C, I_F = I_S$ $di/dt = 100A/\mu s$ ^(Note 3) | - | 101 | | nS |
| Reverse Recovery Charge | Q_{rr} | | - | 193 | | nC |

Notes:

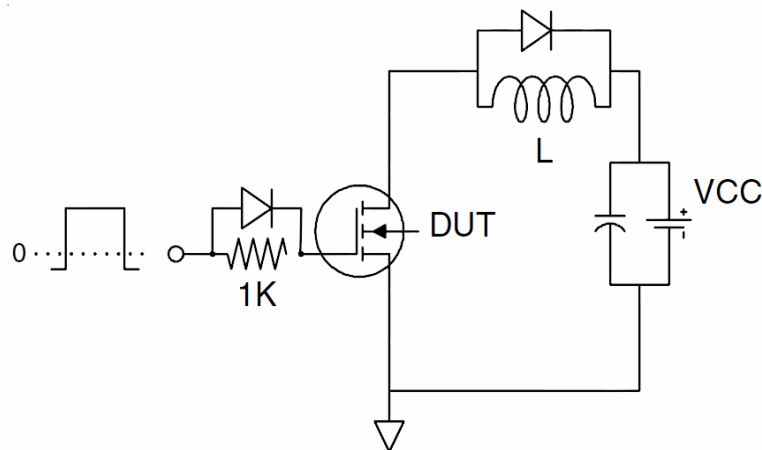
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition : $T_J=25^{\circ}C, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega$

Test Circuit

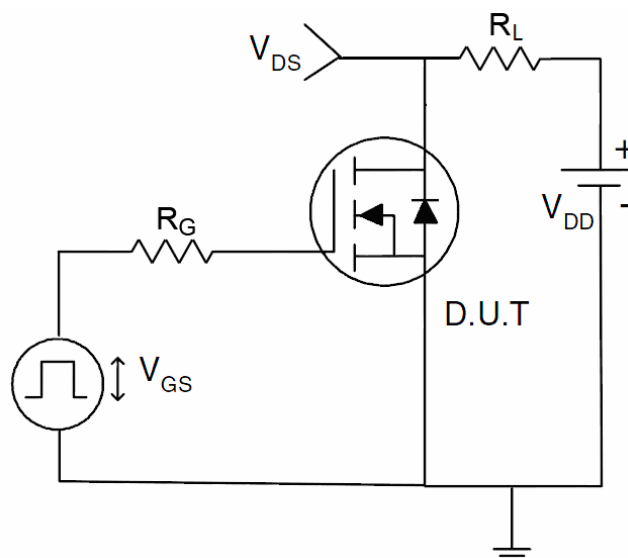
1) E_{AS} test Circuit



2) Gate charge test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics

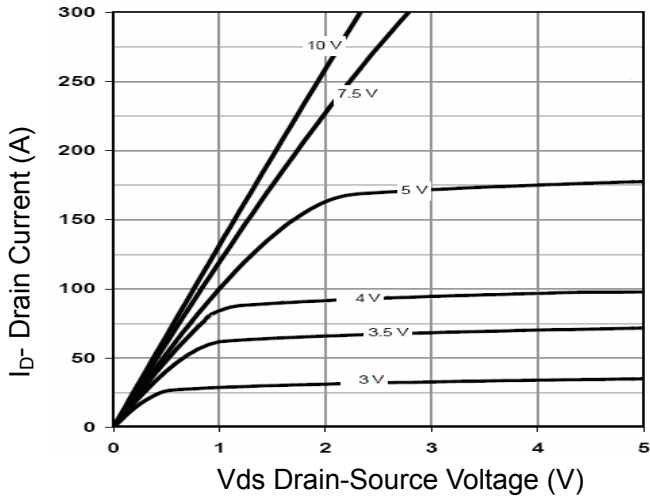


Figure 1 Output Characteristics

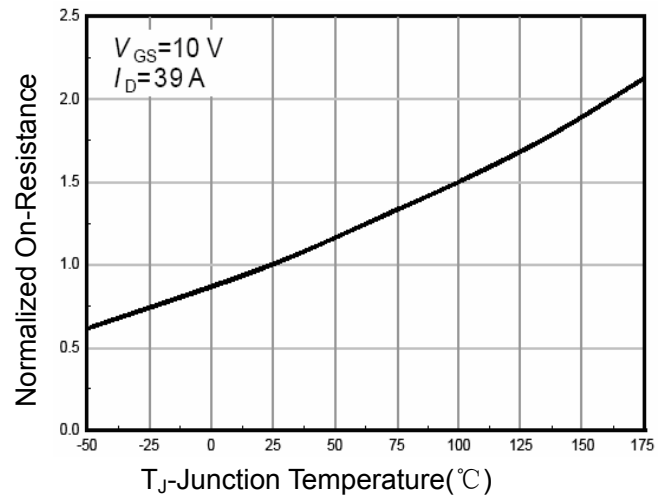


Figure 4 R_{dson} -Junction Temperature

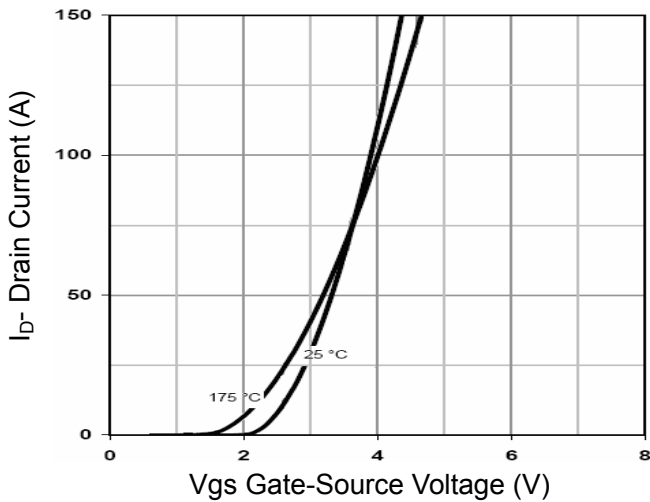


Figure 2 Transfer Characteristics

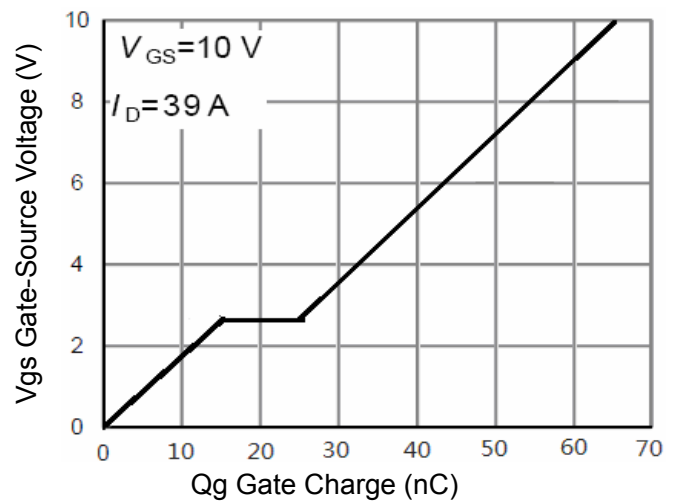


Figure 5 Gate Charge

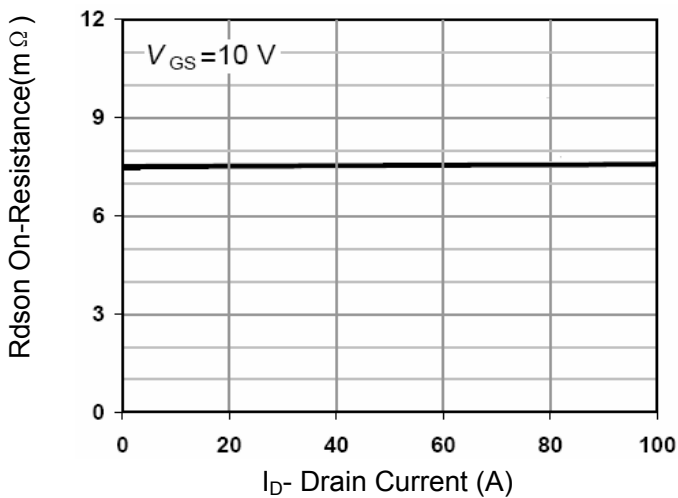


Figure 3 R_{dson} - Drain Current

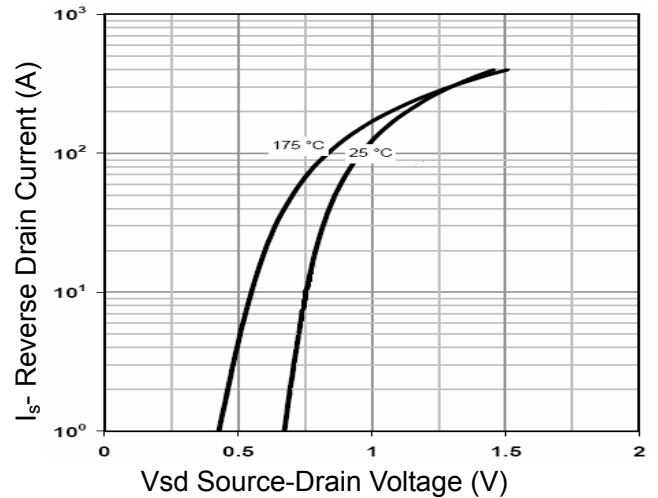


Figure 6 Source- Drain Diode Forward

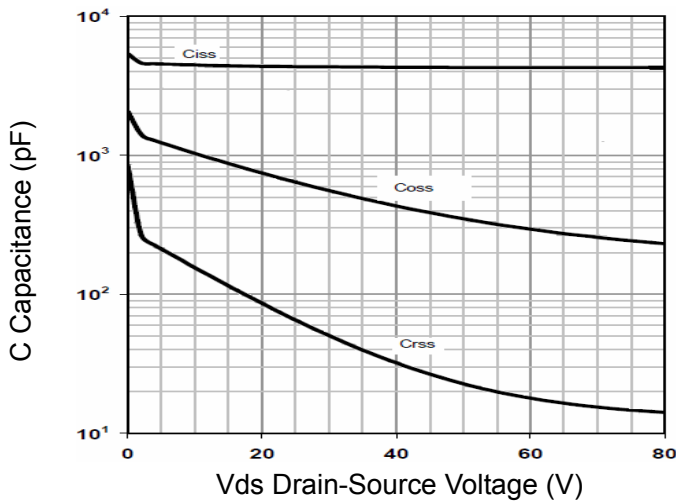


Figure 7 Capacitance vs Vds

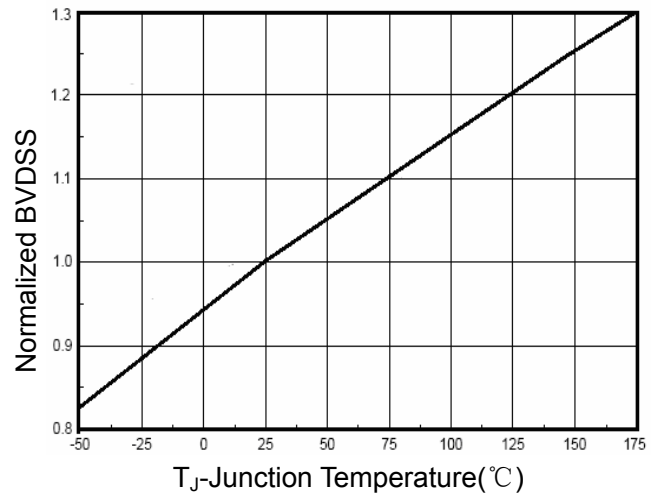


Figure 9 BV_{DSS} vs Junction Temperature

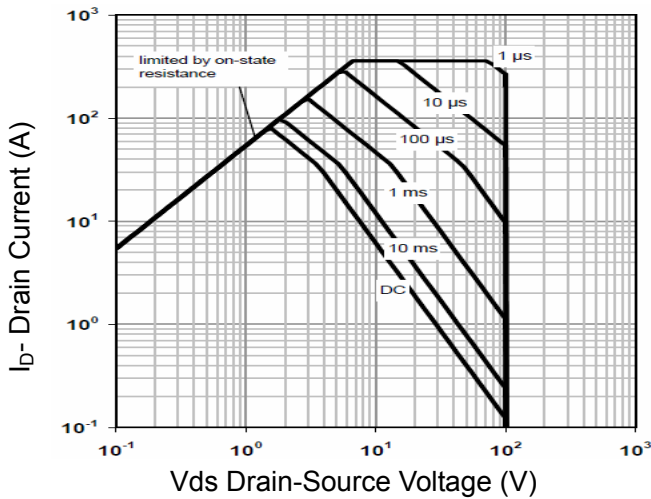


Figure 8 Safe Operation Area

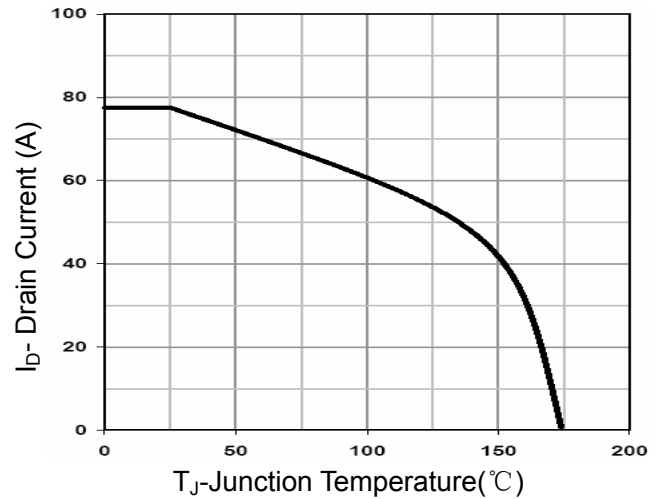


Figure 10 Current De-rating

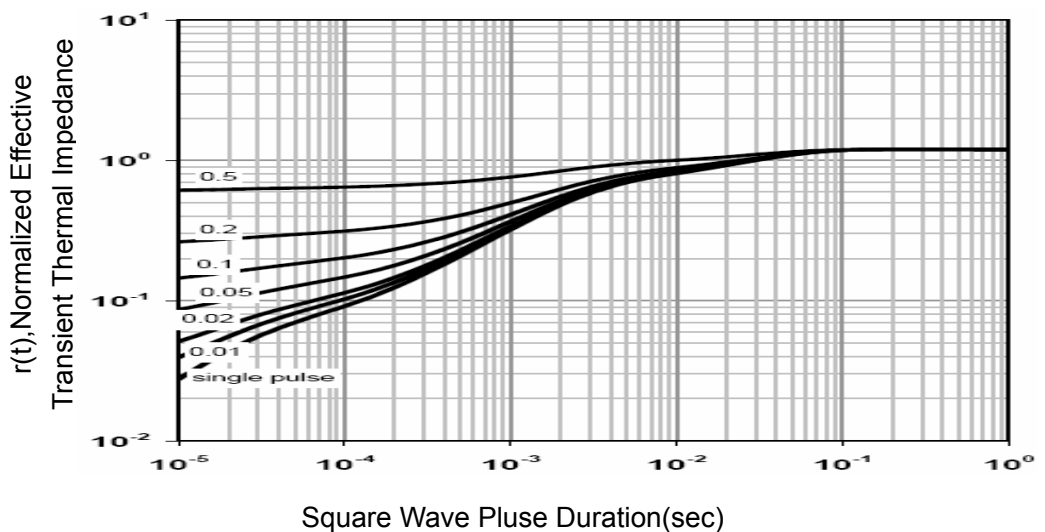


Figure 11 Normalized Maximum Transient Thermal Impedance

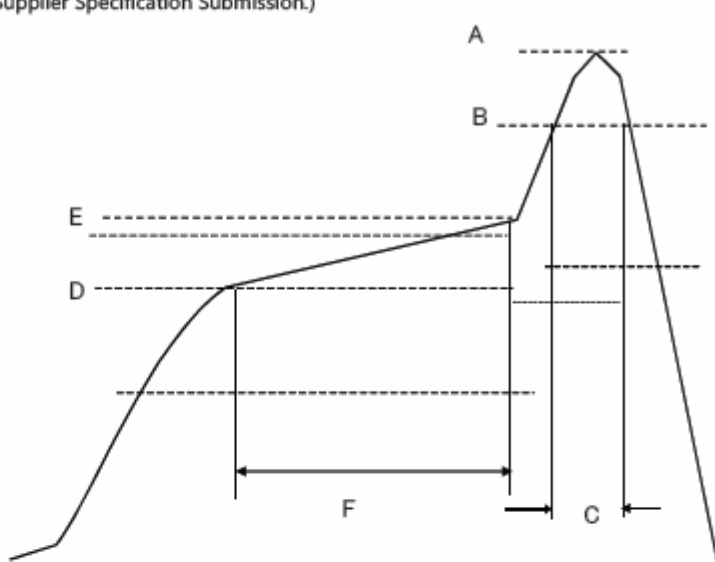
Reflow Curve

The Guarantee Letter of Parts Heat Resistance

新洁能表贴封装产品，有在以下耐热温度条件中保证的可能，建议追记到有关零件承认书的零件耐热保证项目中
(The SMD components of NCE Power have the ability of heat resistance marked below. Please add the information to corresponded items of heat resistance in Supplier Specification Submission.)

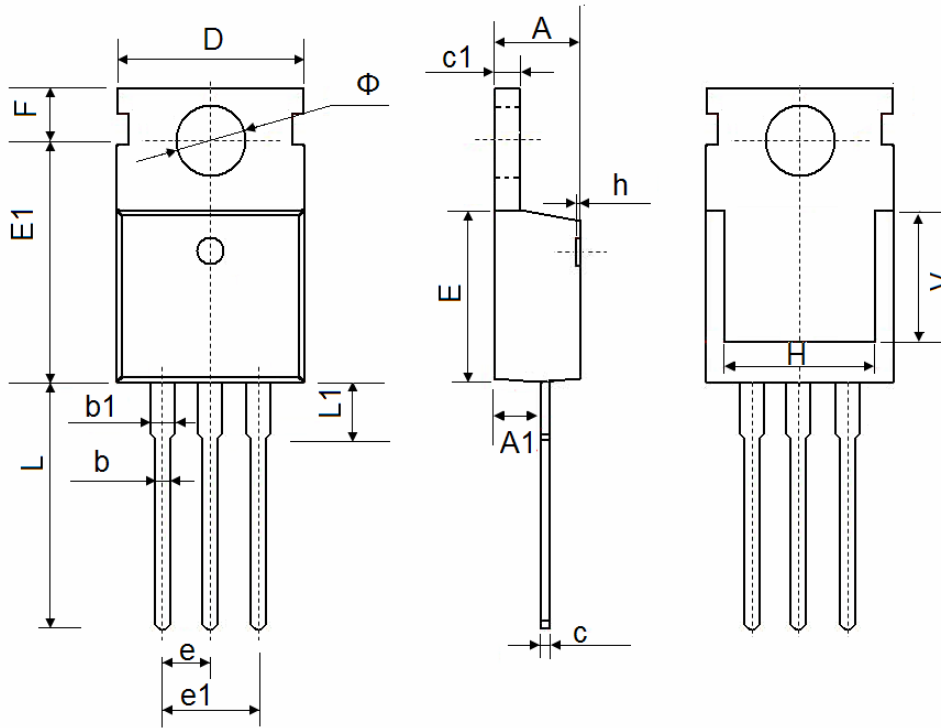
[REFLOW温度PROFILE]
(REFLOW TEMPERATURE PROFILE)

| |
|---|
| 测试POINT：焊接部·part表面 |
| A: 260+5/-0 °C B: 217°C C: 60~150 sec D: 150°C E: 200°C F: 90±10 sec |



| | | | |
|---|---|--|---------------------|
| reflow条件(次数等) (Reflow condition (times)) | <input checked="" type="checkbox"/> 可用以上PROFILE进行3次 (can use the above profile for two times) <input type="checkbox"/> 不可REFLOW (can not Reflow) | | |
| 开封后的吸湿保证条件 (Damp resistance after opening) | <input type="checkbox"/> 无限制 (保管条件 30°C 70%RH以下) (no limit) (store condition: 30 °C 70%RH below) | | |
| 开封后 (after opening) | <input checked="" type="checkbox"/> 开封后 30°C 60%RH168H→REFLOW | | |
| 手焊耐热 (Soldering iron) | 350±10°C 5+1/-0 sec | flow耐热 (flow heat-resistant) | 270±3°C 10+1/-0 sec |
| Pb含有状况 (Pb content status) | 零件外部 (external) | <input checked="" type="checkbox"/> Pb完全无使用 Pb-free <input type="checkbox"/> Pb有使用其位置 (无铅化予定 年 月) Pb used in location (realize Pb-free year month) | |
| | 零件内部 (inside) | <input type="checkbox"/> Pb完全无使用 Pb-free <input checked="" type="checkbox"/> Pb有使用其位置 (内部电极含有Pb, 无铅化予定 年 月) Pb used in the inside electrodes (realize Pb-free year month) | |
| | 电极镀层的组成 (Composition of lead cladding) | <input checked="" type="checkbox"/> Sn, <input type="checkbox"/> Sn-Cu, <input type="checkbox"/> Sn-Ag, <input type="checkbox"/> Sn-Bi, <input type="checkbox"/> 其他(other)() <input type="checkbox"/> Sn-Pb (无铅化予定 年 月) (realize Pb-free year month) | |
| | 无铅区分 (Pb-free manage) | <input type="checkbox"/> 料号变更 (无铅零件料号: ABC12345) P/N changed (Pb-free P/N:) <input checked="" type="checkbox"/> 料号不变,自然切换 (切换时间点: 年 月 日) P/N not changed,switch naturally (switch time: year month date) | |

| | |
|------------|-------------------------|
| Solder Dip | 260°C /10Sec Whole body |
|------------|-------------------------|

TO-220-3L Package Information


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.400 | 4.600 | 0.173 | 0.181 |
| A1 | 2.250 | 2.550 | 0.089 | 0.100 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 1.370 | 0.046 | 0.054 |
| c | 0.330 | 0.650 | 0.013 | 0.026 |
| c1 | 1.200 | 1.400 | 0.047 | 0.055 |
| D | 9.910 | 10.250 | 0.390 | 0.404 |
| E | 8.9500 | 9.750 | 0.352 | 0.384 |
| E1 | 12.650 | 12.950 | 0.498 | 0.510 |
| e | 2.540 TYP. | | 0.100 TYP. | |
| e1 | 4.980 | 5.180 | 0.196 | 0.204 |
| F | 2.650 | 2.950 | 0.104 | 0.116 |
| H | 7.900 | 8.100 | 0.311 | 0.319 |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| L | 12.900 | 13.400 | 0.508 | 0.528 |
| L1 | 2.850 | 3.250 | 0.112 | 0.128 |
| V | 7.500 REF. | | 0.295 REF. | |
| Φ | 3.400 | 3.800 | 0.134 | 0.150 |

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