

# N-Channel Enhancement Mode Power MOSFET

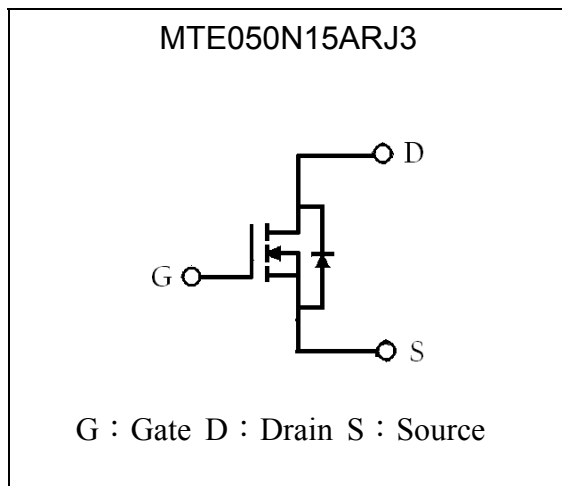
## MTE050N15ARJ3

|   |                    |
|---|--------------------|
| <b>BV<sub>DSS</sub></b>   | <b>150V</b>        |
| <b>I<sub>D</sub>@T<sub>C</sub>=25°C, V<sub>GS</sub>=10V</b>     | <b>20A</b>         |
| <b>R<sub>DS(ON)</sub>@V<sub>GS</sub>=10V, I<sub>D</sub>=15A</b> | <b>48 mΩ (typ)</b> |

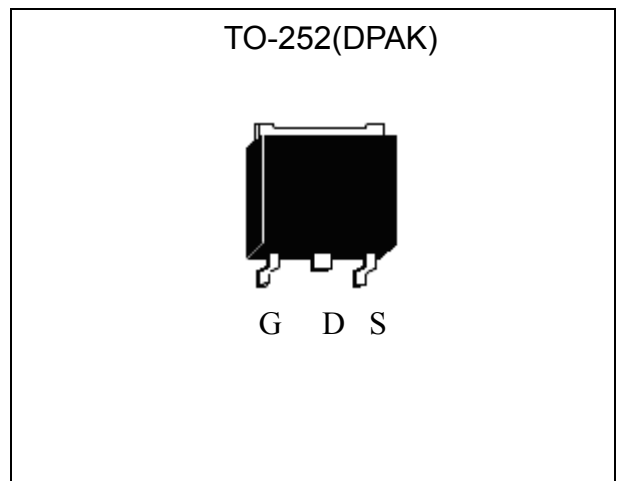
### Features

- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant package

### Symbol

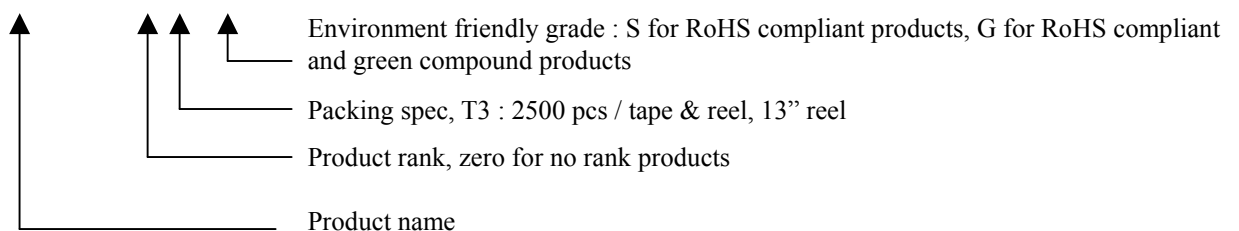


### Outline



### Ordering Information

| Device               | Package   | Shipping               |
|----------------------|---|------------------------|
| MTE050N15ARJ3-0-T3-G | TO-252<br>(Pb-free lead plating and halogen-free package) | 2500 pcs / Tape & Reel |



**Absolute Maximum Ratings** ( $T_C=25^{\circ}\text{C}$ )

| Parameter  | Symbol         | Limits                             | Unit               |     |
|--|----------------|------------------------------------|--------------------|-----|
| Drain-Source Voltage (Note 1)  | $V_{DS}$       | 150                                | V                  |     |
| Gate-Source Voltage  | $V_{GS}$       | $\pm 20$                           |                    |     |
| Continuous Drain Current @ $T_C=25^{\circ}\text{C}$ , $V_{GS}=10\text{V}$ (Note 1)                       | $I_D$          | 20                                 | A                  |     |
| Continuous Drain Current @ $T_C=100^{\circ}\text{C}$ , $V_{GS}=10\text{V}$ (Note 1)                      |                | 14                                 |                    |     |
| Continuous Drain Current @ $T_A=25^{\circ}\text{C}$ , $V_{GS}=10\text{V}$ (Note 2)                       | $I_{DSM}$      | 4.3                                |                    |     |
| Continuous Drain Current @ $T_A=70^{\circ}\text{C}$ , $V_{GS}=10\text{V}$ (Note 2)                       |                | 3.4                                |                    |     |
| Pulsed Drain Current @ $V_{GS}=10\text{V}$   | $I_{DM}$       | 60                                 |                    |     |
| Avalanche Current @ $L=0.1\text{mH}$ (Note 3)  | $I_{AR}$       | 40                                 |                    |     |
| Single Pulse Avalanche Energy @ $L=0.5\text{mH}$ , $I_D=20\text{Amps}$ ,<br>$V_{DD}=50\text{V}$ (Note 5) | $E_{AS}$       | 100                                |                    | mJ  |
| Repetitive Avalanche Energy (Note 3)   | $E_{AR}$       | 6                                  | W                  |     |
| Power Dissipation  | $P_D$          | $T_C=25^{\circ}\text{C}$ (Note 1)  |                    | 60  |
|  |                | $T_C=100^{\circ}\text{C}$ (Note 1) |                    | 30  |
|  | $P_{DSM}$      | $T_A=25^{\circ}\text{C}$ (Note 2)  |                    | 2.5 |
|  |                | $T_A=70^{\circ}\text{C}$ (Note 2)  |                    | 1.6 |
| Operating Junction and Storage Temperature   | $T_j, T_{stg}$ | -55~+175                           | $^{\circ}\text{C}$ |     |

\*Drain current limited by maximum junction temperature

**Thermal Data**

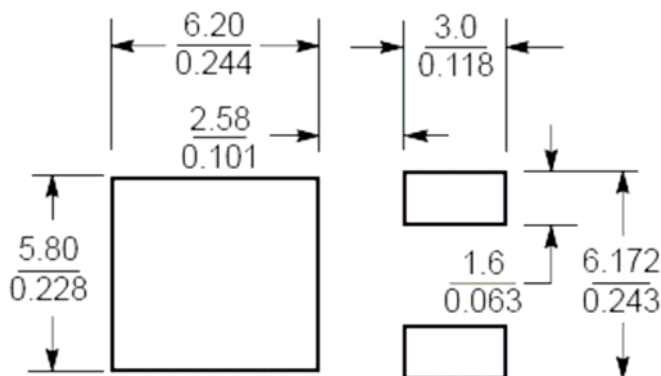
| Parameter   | Symbol          | Value | Unit                        |
|---|-----------------|-------|-----------------------------|
| Thermal Resistance, Junction-to-case, max             | $R_{\theta JC}$ | 2.5   | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-ambient, max (Note 2) | $R_{\theta JA}$ | 50    |                             |
| Thermal Resistance, Junction-to-ambient, max (Note 4) |                 | 110   |                             |

- Note : 1. The power dissipation  $P_D$  is based on  $T_{J(MAX)}=175^{\circ}\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
2. The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2 oz. copper, in a still air environment with  $T_A=25^{\circ}\text{C}$ . The power dissipation  $P_{DSM}$  is based on  $R_{\theta JA}$  and the maximum allowed junction temperature of  $150^{\circ}\text{C}$ . The value in any given application depends on the user's specific board design, and the maximum temperature of  $175^{\circ}\text{C}$  may be used if the PCB allows it.
3. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=175^{\circ}\text{C}$ . Ratings are based on low frequency and low duty cycles to keep initial  $T_j=25^{\circ}\text{C}$ .
4. When mounted on the minimum pad size recommended (PCB mount),  $t \leq 10\text{s}$ .
5. 100% tested by conditions of  $V_{DD}=50\text{V}$ ,  $L=0.1\text{mH}$ ,  $V_{GS}=10\text{V}$ ,  $I_{AS}=10\text{A}$

**Characteristics (T<sub>j</sub>=25°C, unless otherwise specified)**

| Symbol                              | Min. | Typ. | Max. | Unit | Test Conditions   |
|-------------------------------------|------|------|------|------|---|
| <b>Static</b>                       |      |      |      |      |   |
| BV <sub>DSS</sub>                   | 150  | -    | -    | V    | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA  |
| ΔBV <sub>DSS</sub> /ΔT <sub>j</sub> | -    | 0.13 | -    | V/°C | Reference to 25°C, I <sub>D</sub> =250μA  |
| V <sub>GS(th)</sub>                 | 2.0  | -    | 4.0  | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA                           |
| *G <sub>FS</sub>                    | -    | 14.4 | -    | S    | V <sub>DS</sub> = 5V, I <sub>D</sub> =10A   |
| I <sub>GSS</sub>                    | -    | -    | ±100 | nA   | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V  |
| I <sub>DSS</sub>                    | -    | -    | 1    | μA   | V <sub>DS</sub> = 120V, V <sub>GS</sub> = 0V  |
| I <sub>DSS</sub>                    | -    | -    | 25   |      | V <sub>DS</sub> = 120V, V <sub>GS</sub> = 0V, T <sub>j</sub> =125°C                 |
| *R <sub>DS(ON)</sub>                | -    | 48   | 65   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> =15A  |
| <b>Dynamic</b>                      |      |      |      |      |   |
| *Q <sub>g</sub>                     | -    | 22.7 | -    | nC   | V <sub>DD</sub> =75V, I <sub>D</sub> =15A, V <sub>GS</sub> =10V                     |
| *Q <sub>gs</sub>                    | -    | 5.7  | -    |      |   |
| *Q <sub>gd</sub>                    | -    | 5.5  | -    |      |   |
| *t <sub>d(ON)</sub>                 | -    | 14.2 | -    | ns   | V <sub>DD</sub> =75V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω |
| *t <sub>r</sub>                     | -    | 16.6 | -    |      |   |
| *t <sub>d(OFF)</sub>                | -    | 28.6 | -    |      |   |
| *t <sub>f</sub>                     | -    | 8.8  | -    |      |   |
| C <sub>iss</sub>                    | -    | 1269 | -    | pF   | V <sub>GS</sub> =0V, V <sub>DS</sub> =80V, f=1MHz                                   |
| C <sub>oss</sub>                    | -    | 76   | -    |      |   |
| C <sub>rss</sub>                    | -    | 10   | -    |      |   |
| <b>Source-Drain Diode</b>           |      |      |      |      |   |
| *I <sub>S</sub>                     | -    | -    | 20   | A    |   |
| *I <sub>SM</sub>                    | -    | -    | 60   |      |   |
| *V <sub>SD</sub>                    | -    | 0.85 | 1.2  | V    | I <sub>S</sub> =10A, V <sub>GS</sub> =0V  |
| *t <sub>rr</sub>                    | -    | 54   | -    | ns   | V <sub>GS</sub> =0V, I <sub>F</sub> =10A, dI <sub>F</sub> /dt=100A/μs               |
| *Q <sub>rr</sub>                    | -    | 124  | -    | nC   |   |

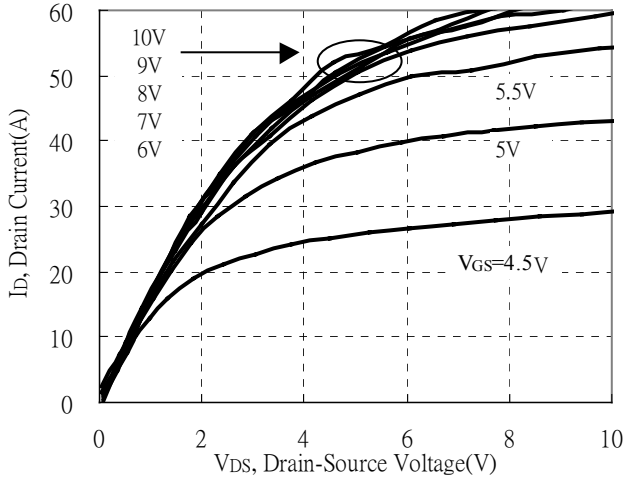
\*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

**Recommended soldering footprint**

 Unit (  $\frac{\text{mm}}{\text{inch}}$  )

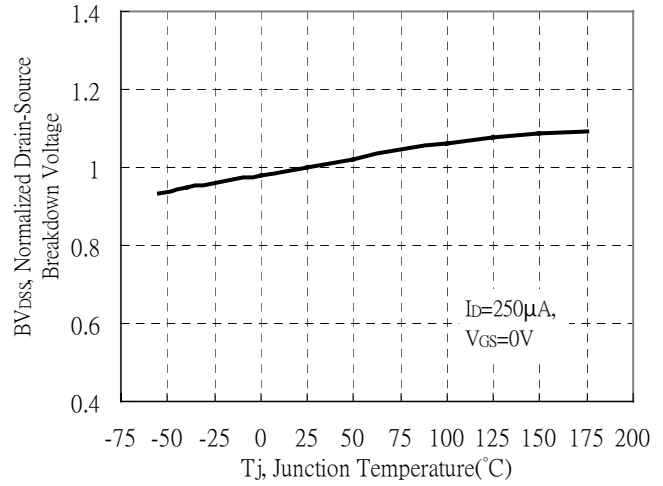


**Typical Characteristics**

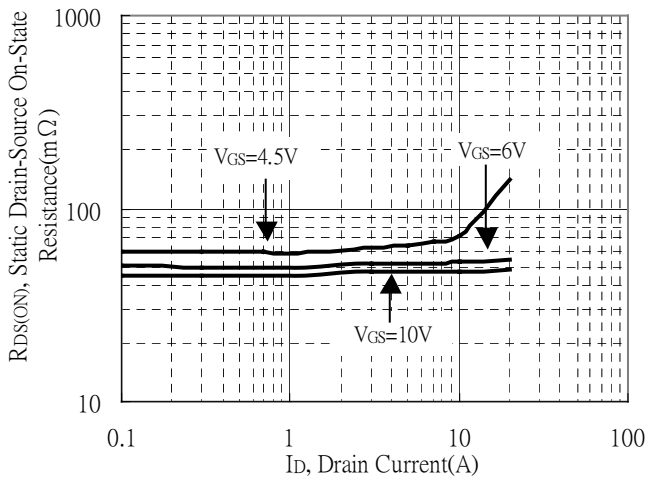
Typical Output Characteristics



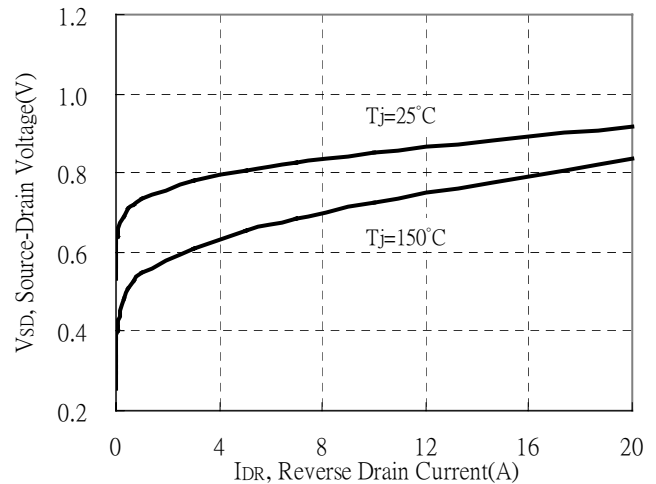
Breakdown Voltage vs Ambient Temperature



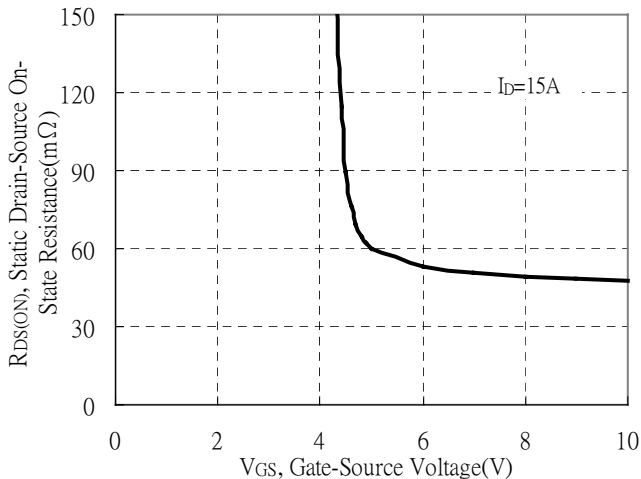
Static Drain-Source On-State resistance vs Drain Current



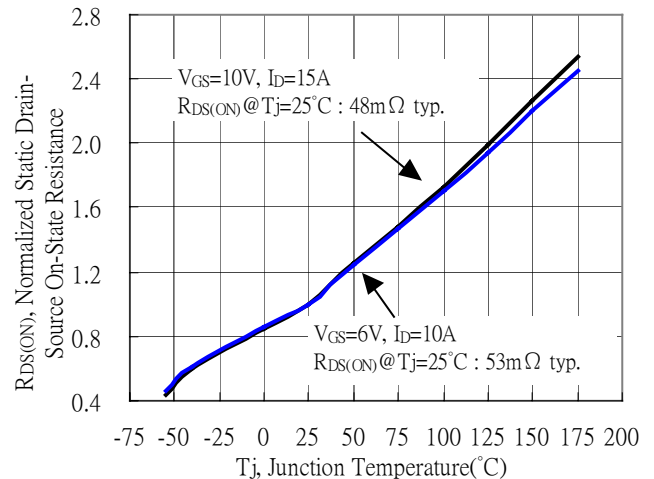
Reverse Drain Current vs Source-Drain Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

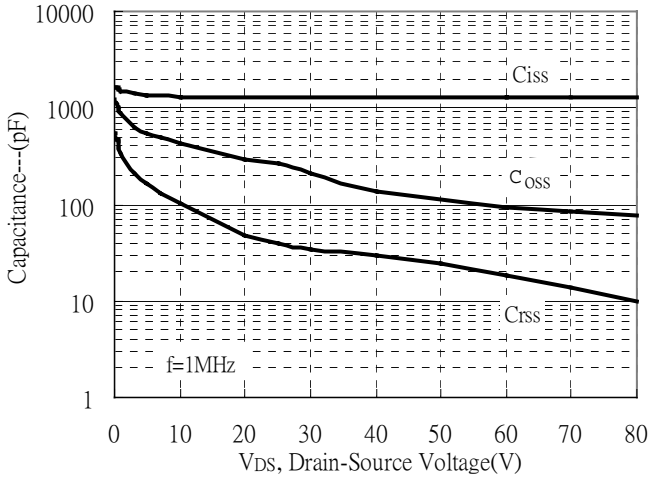


Drain-Source On-State Resistance vs Junction Temperature

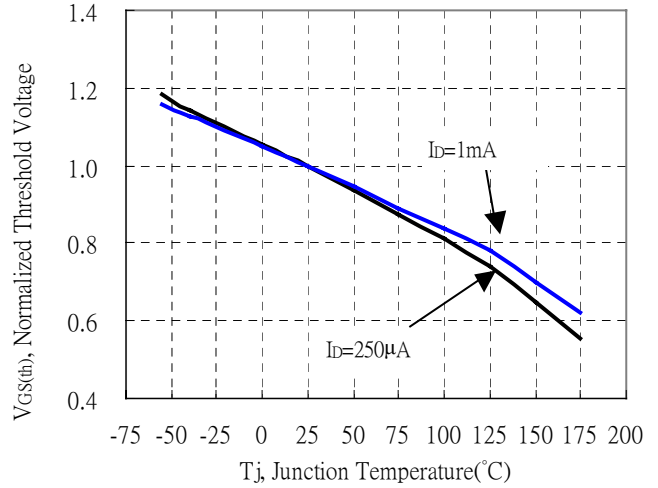


**Typical Characteristics(Cont.)**

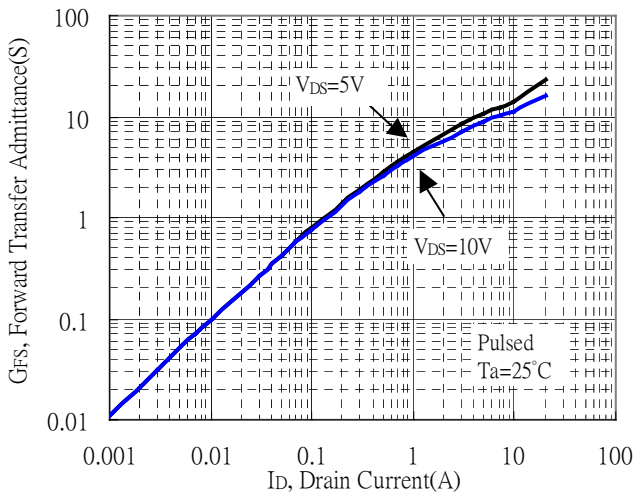
Capacitance vs Drain-to-Source Voltage



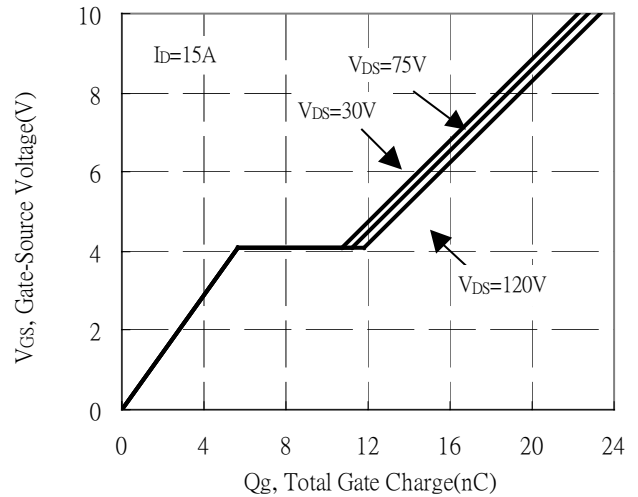
Threshold Voltage vs Junction Temperature



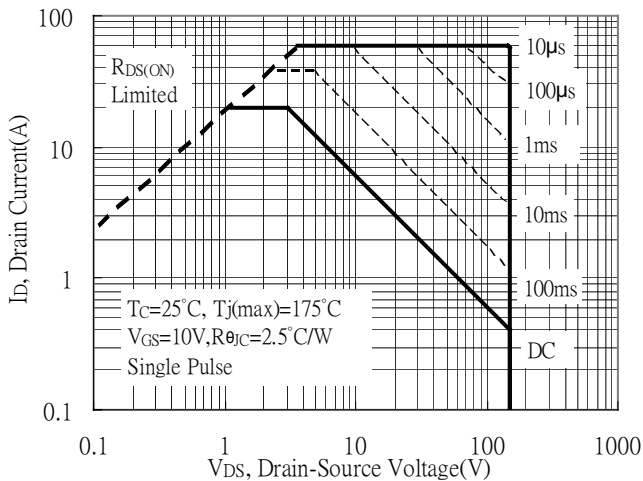
Forward Transfer Admittance vs Drain Current



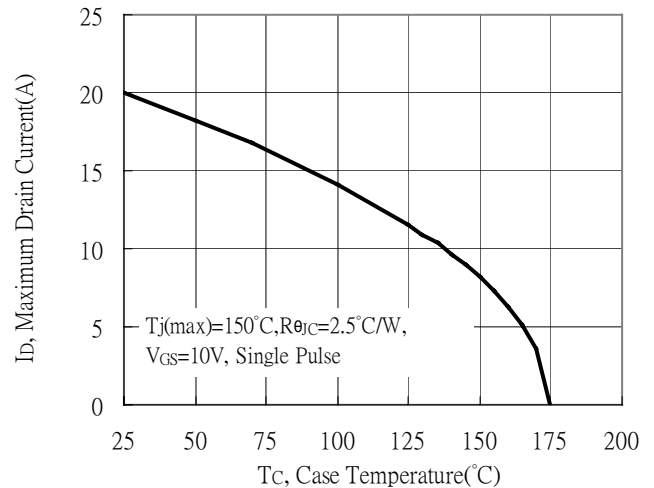
Gate Charge Characteristics



Maximum Safe Operating Area

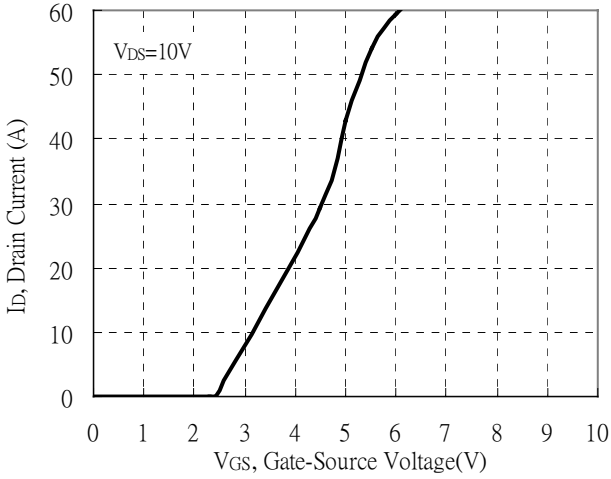


Maximum Drain Current vs Case Temperature

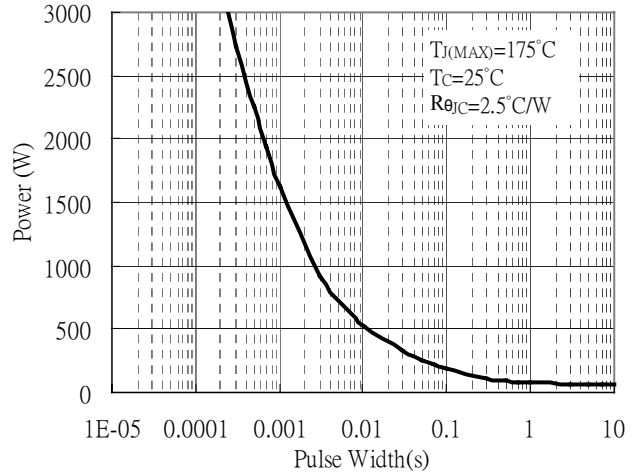


**Typical Characteristics(Cont.)**

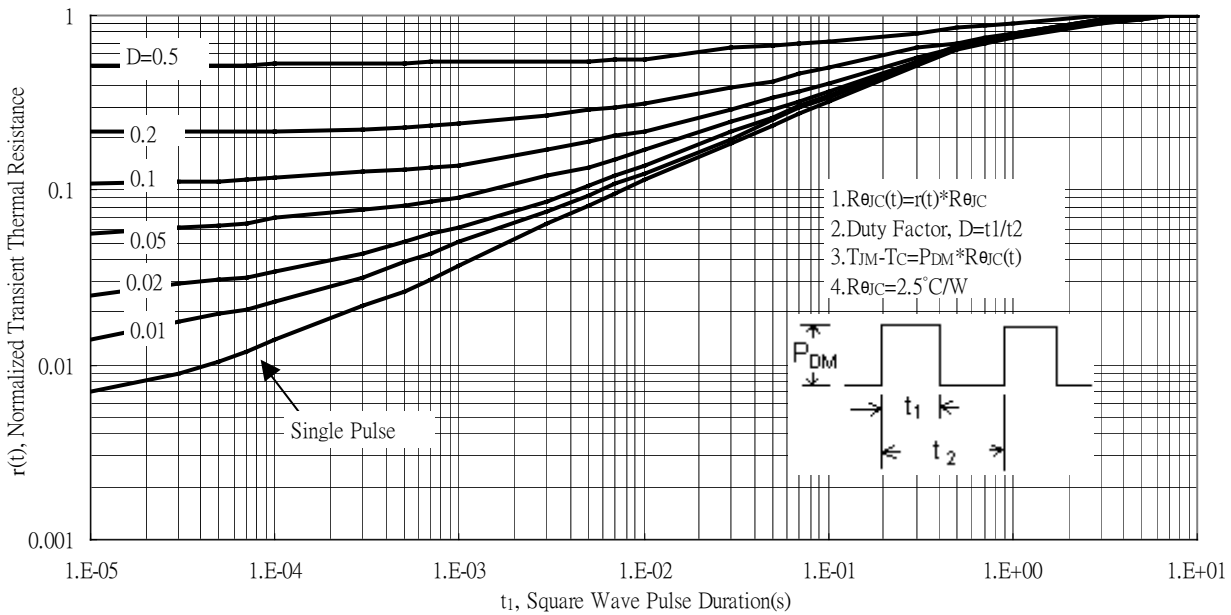
Typical Transfer Characteristics



Single Pulse Power Rating, Junction to Case



Transient Thermal Response Curves





**Recommended wave soldering condition**

| Product         | Peak Temperature | Soldering Time  |
|-----------------|------------------|-----------------|
| Pb-free devices | 260 +0/-5 °C     | 5 +1/-1 seconds |

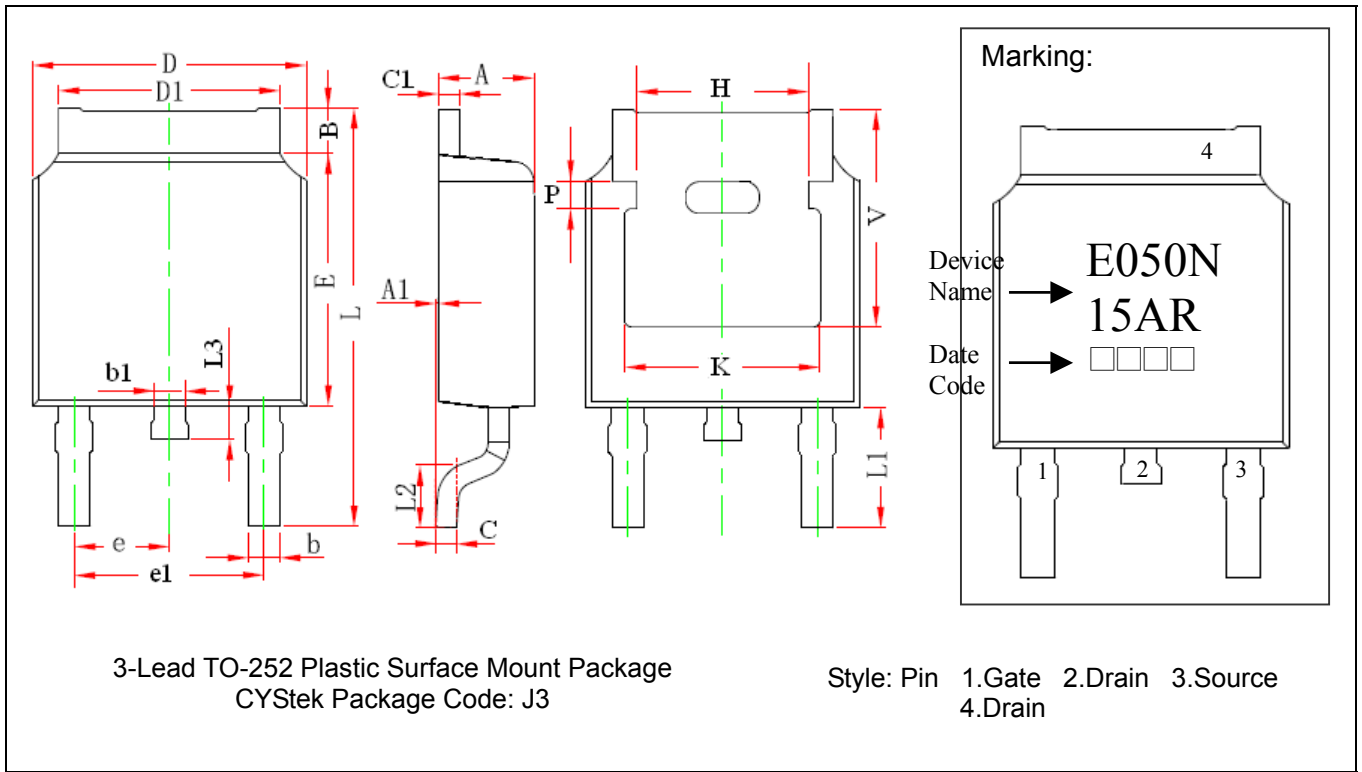
**Recommended temperature profile for IR reflow**


| Profile feature                                | Sn-Pb eutectic Assembly | Pb-free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate (Tsmax to Tp)             | 3°C/second max.         | 3°C/second max.  |
| Preheat  |                         |                  |
| -Temperature Min(Ts min)                       | 100°C                   | 150°C            |
| -Temperature Max(Ts max)                       | 150°C                   | 200°C            |
| -Time(ts min to ts max)                        | 60-120 seconds          | 60-180 seconds   |
| Time maintained above:                         |                         |                  |
| -Temperature (TL)                              | 183°C                   | 217°C            |
| - Time (tL)                                    | 60-150 seconds          | 60-150 seconds   |
| Peak Temperature(TP)                           | 240 +0/-5 °C            | 260 +0/-5 °C     |
| Time within 5°C of actual peak temperature(tp) | 10-30 seconds           | 20-40 seconds    |
| Ramp down rate                                 | 6°C/second max.         | 6°C/second max.  |
| Time 25 °C to peak temperature                 | 6 minutes max.          | 8 minutes max.   |

Note : All temperatures refer to topside of the package, measured on the package body surface.



**TO-252 Dimension**



| DIM | Inches |       | Millimeters |       | DIM | Inches |       | Millimeters |        |
|-----|--------|-------|-------------|-------|-----|--------|-------|-------------|--------|
|     | Min.   | Max.  | Min.        | Max.  |     | Min.   | Max.  | Min.        | Max.   |
| A   | 0.087  | 0.094 | 2.200       | 2.400 | e   | 0.086  | 0.094 | 2.186       | 2.386  |
| A1  | 0.000  | 0.005 | 0.000       | 0.127 | e1  | 0.172  | 0.188 | 4.372       | 4.772  |
| B   | 0.039  | 0.048 | 0.990       | 1.210 | H   | 0.163  | REF   | 4.140       | REF    |
| b   | 0.026  | 0.034 | 0.660       | 0.860 | K   | 0.190  | REF   | 4.830       | REF    |
| b1  | 0.026  | 0.034 | 0.660       | 0.860 | L   | 0.386  | 0.409 | 9.800       | 10.400 |
| C   | 0.018  | 0.023 | 0.460       | 0.580 | L1  | 0.114  | REF   | 2.900       | REF    |
| C1  | 0.018  | 0.023 | 0.460       | 0.580 | L2  | 0.055  | 0.067 | 1.400       | 1.700  |
| D   | 0.256  | 0.264 | 6.500       | 6.700 | L3  | 0.024  | 0.039 | 0.600       | 1.000  |
| D1  | 0.201  | 0.215 | 5.100       | 5.460 | P   | 0.026  | REF   | 0.650       | REF    |
| E   | 0.236  | 0.244 | 6.000       | 6.200 | V   | 0.211  | REF   | 5.350       | REF    |

- Notes:**
- Controlling dimension: millimeters.
  - Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
  - If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead : Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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