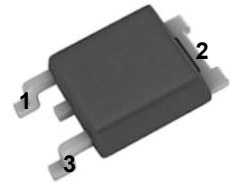
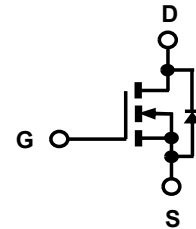


## ICEK9NF65D N-Channel Enhancement Mode MOSFET

### Features

- Good FOM performance
- EMI-Friendly
- Optimized design for High Frequency Switching, and Quick Charging and Adapter

| Product Summary |                          |       |     |
|-----------------|--------------------------|-------|-----|
| $I_D$           | $T_A=25^{\circ}\text{C}$ | 9.1A  | Max |
| $V_{(BR)DSS}$   | $I_D=250\mu\text{A}$     | 650V  | Min |
| $r_{DS(on)}$    | $V_{GS}=10\text{V}$      | 0.302 | Typ |
| $Q_g$           | $V_{DS}=480\text{V}$     | 20nC  | Typ |



T0252

Standard Metal  
Heatsink

1=Gate, 2=Drain,  
3=Source.



**Maximum ratings**<sup>a</sup> at  $T_j=25^{\circ}\text{C}$ , unless otherwise specified

| Parameter                                  | Symbol                | Conditions                                                                     | Value       | Unit               |
|--------------------------------------------|-----------------------|--------------------------------------------------------------------------------|-------------|--------------------|
| Continuous drain current <sup>b</sup>      | $I_D$                 | $T_c=25^{\circ}\text{C}$                                                       | 9.1         | A                  |
|                                            |                       | $T_c=100^{\circ}\text{C}$                                                      | 5.7         |                    |
| Pulsed drain current <sup>b</sup>          | $I_{D, \text{pulse}}$ | $T_c=25^{\circ}\text{C}$                                                       | 34          | A                  |
| Avalanche energy, single pulse             | $E_{AS}$              | $L=75\text{mH}$ , $V_{DD}=100\text{V}$ ,<br>$I_D=1.2\text{A}$ , $R_G=50\Omega$ | 54          | mJ                 |
| Avalanche current, repetitive <sup>b</sup> | $I_{AR}$              | limited by $T_{j\text{max}}$                                                   | 1.2         | A                  |
| MOSFET $dv/dt$ ruggedness                  | $dv/dt$               | $V_{DS}=480\text{V}$                                                           | 50          | V/ns               |
| Reverse diode $dv/dt$ ruggedness           |                       |                                                                                | 50          |                    |
| Gate source voltage                        | $V_{GS}$              | Static                                                                         | $\pm 30$    | V                  |
|                                            |                       | AC ( $f>1\text{Hz}$ )                                                          |             |                    |
| Power dissipation                          | $P_{\text{tot}}$      | $T_c=25^{\circ}\text{C}$                                                       | 75.8        | W                  |
| Operating and storage temperature          | $T_j, T_{\text{stg}}$ |                                                                                | -55 to +150 | $^{\circ}\text{C}$ |

<sup>a</sup> Preliminary data sheet - Specifications subject to change.

<sup>b</sup> limited by  $T_{j\text{max}}$

<sup>c</sup> when mounted on 1-inch square 2oz copper-clad FR-4

| Parameter | Symbol | Conditions | Values |     |     | Unit |
|-----------|--------|------------|--------|-----|-----|------|
|           |        |            | Min    | Typ | Max |      |

### Thermal characteristics

|                                                             |            |                                     |   |   |      |      |
|-------------------------------------------------------------|------------|-------------------------------------|---|---|------|------|
| Thermal resistance, junction-case                           | $R_{thJC}$ |                                     | - | - | 1.65 | °C/W |
| Thermal resistance, junction-ambient °                      | $R_{thJA}$ | leaded                              | - | - | 60   |      |
| Soldering temperature, wave soldering only allowed at leads | $T_{sold}$ | 1.6mm (0.063in.) from case for 10 s | - | - | 260  | °C   |

### Electrical characteristics at $T_j=25^{\circ}\text{C}$ , unless otherwise specified

#### Static characteristics

|                                  |               |                               |     |       |           |          |
|----------------------------------|---------------|-------------------------------|-----|-------|-----------|----------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$     | 650 | -     | -         | V        |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2.5 | 3.4   | 4.5       |          |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=650V, V_{GS}=0V$      | -   | -     | 10        | $\mu A$  |
| Gate source leakage current      | $I_{GSS}$     | $V_{GS}=\pm 30V, V_{DS}=0V$   | -   | -     | $\pm 100$ | nA       |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=10V, I_D=5A$          | -   | 0.302 | 0.36      | $\Omega$ |
| Gate resistance                  | $R_G$         | $f=1\text{ MHz}$ , open drain | -   | 16    | -         | $\Omega$ |

#### Dynamic characteristics

|                              |              |                                                           |   |     |   |    |
|------------------------------|--------------|-----------------------------------------------------------|---|-----|---|----|
| Input capacitance            | $C_{iss}$    | $V_{DS}=400V, V_{GS}=0V, f=1\text{ MHz}$                  | - | 530 | - | pF |
| Output capacitance           | $C_{oss}$    |                                                           | - | 15  | - |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                           | - | 5.5 | - |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DS}=400V, V_{GS}=10V, I_D=5A, R_G=5\Omega$ (External) | - | 52  | - | ns |
| Rise time                    | $t_r$        |                                                           | - | 7   | - |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                           | - | 37  | - |    |
| Fall time                    | $t_f$        |                                                           | - | 10  | - |    |

| Parameter | Symbol | Conditions | Values |     |     | Unit |
|-----------|--------|------------|--------|-----|-----|------|
|           |        |            | Min    | Typ | Max |      |

### Gate charge characteristics

|                       |          |                                                        |   |    |   |    |
|-----------------------|----------|--------------------------------------------------------|---|----|---|----|
| Gate to source charge | $Q_{gs}$ | $V_{DS}=480V, I_D=9.1A,$<br>$V_{GS}=0 \text{ to } 10V$ | - | 4  | - | nC |
| Gate to drain charge  | $Q_{gd}$ |                                                        | - | 11 | - |    |
| Gate charge total     | $Q_g$    |                                                        | - | 20 | - |    |

### Reverse Diode

|                               |          |                                                                  |   |      |     |               |
|-------------------------------|----------|------------------------------------------------------------------|---|------|-----|---------------|
| Continuous forward current    | $I_S$    | $V_{GS}=0V$                                                      | - | -    | 9.1 | A             |
| Diode forward voltage         | $V_{SD}$ | $V_{GS}=0V, I_S=5A$                                              | - | 1.05 | -   | V             |
| Reverse recovery time         | $t_{rr}$ | $V_{RR}=400V, I_S=5A,$<br>$d_{iF}/d_t=100 \text{ A}/\mu\text{S}$ | - | 59   | -   | ns            |
| Reverse recovery charge       | $Q_{rr}$ |                                                                  | - | 0.35 | -   | $\mu\text{C}$ |
| Peak reverse recovery current | $I_{rm}$ |                                                                  | - | 13   | -   | A             |

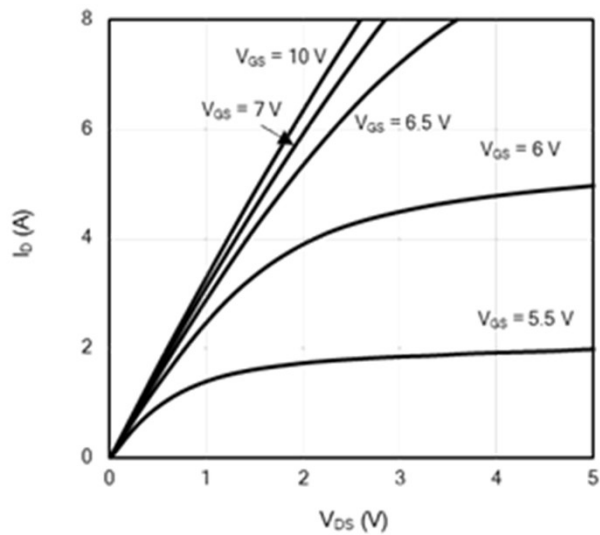


Figure 1: On-Region Characteristics

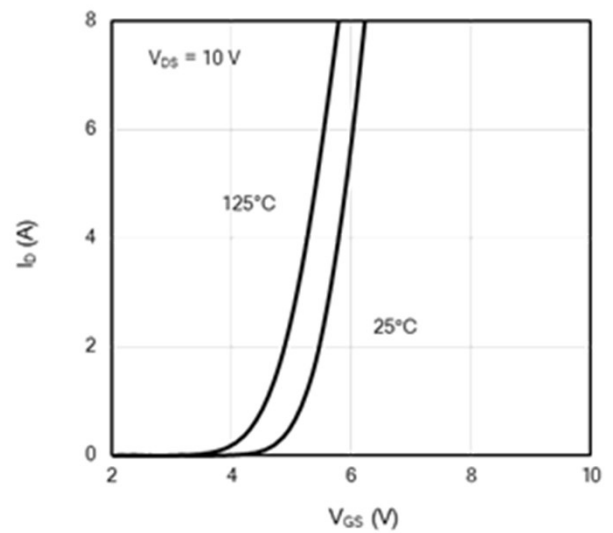


Figure 2: Transfer Characteristics

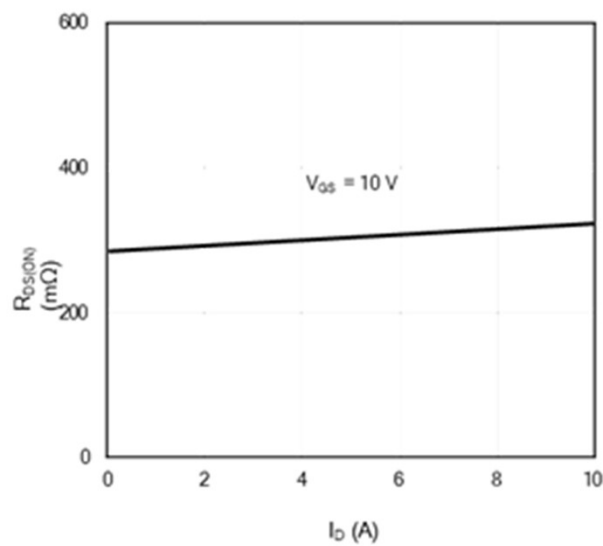


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

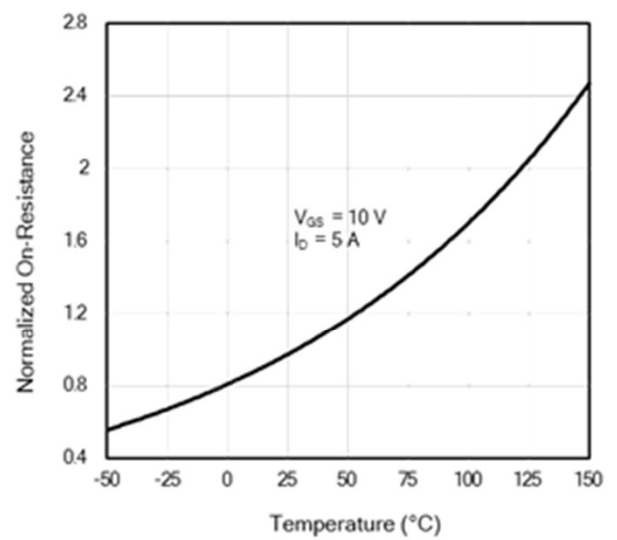


Figure 4: On-Resistance vs. Junction Temperature

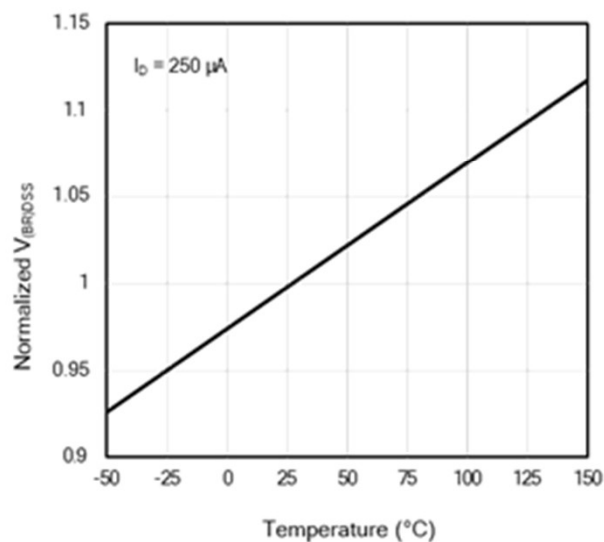


Figure 5: Breakdown Voltage vs. Junction Temperature

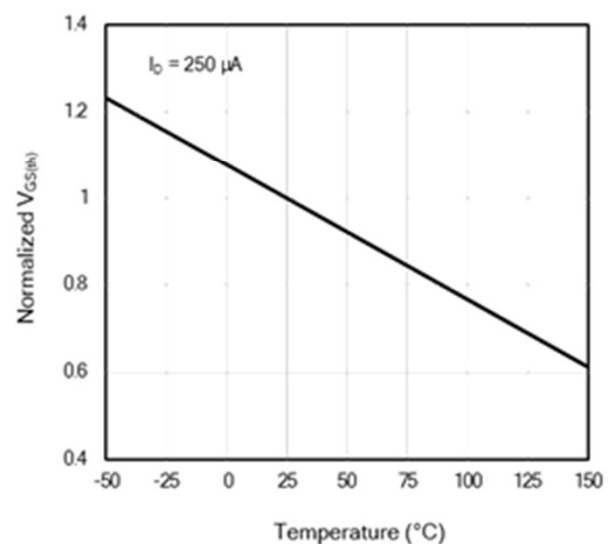


Figure 6: Threshold Voltage vs. Junction Temperature

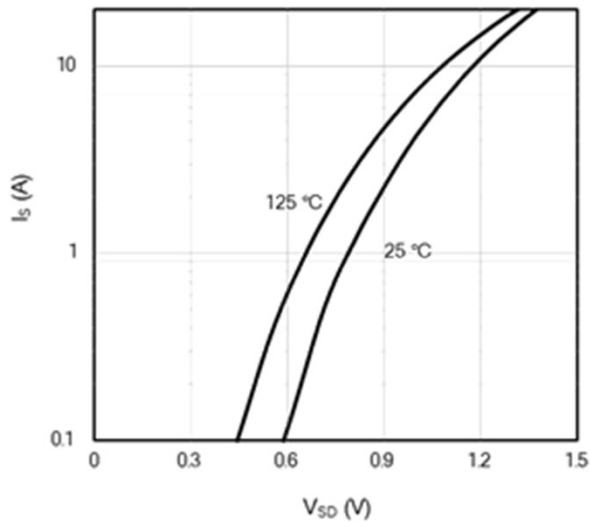


Figure 7: Body-Diode Characteristics

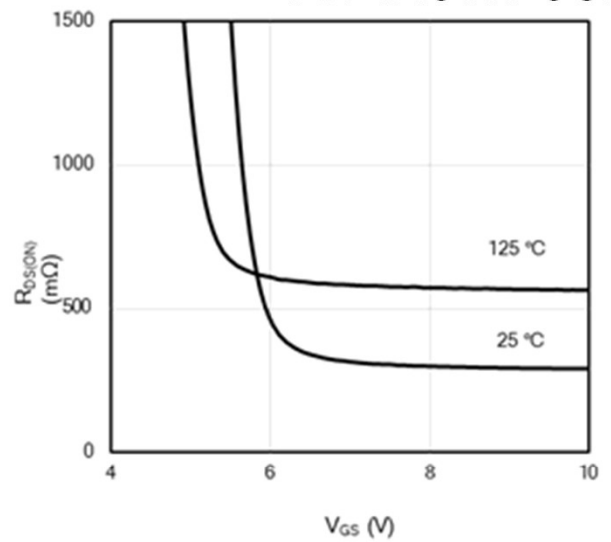


Figure 8: On-Resistance vs. Gate-Source Voltage

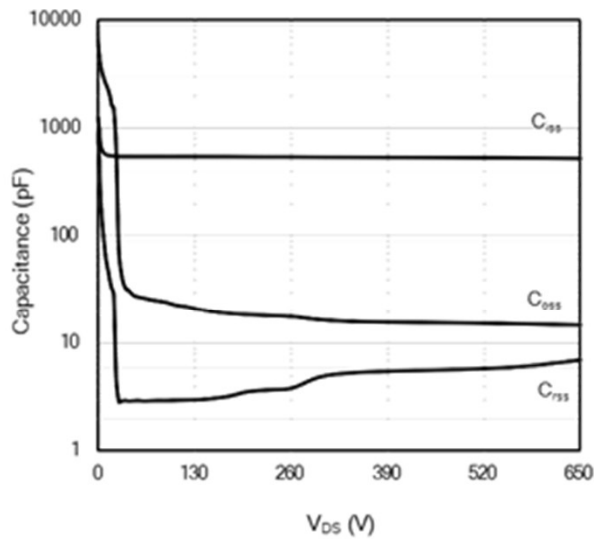


Figure 9: Capacitance Characteristics

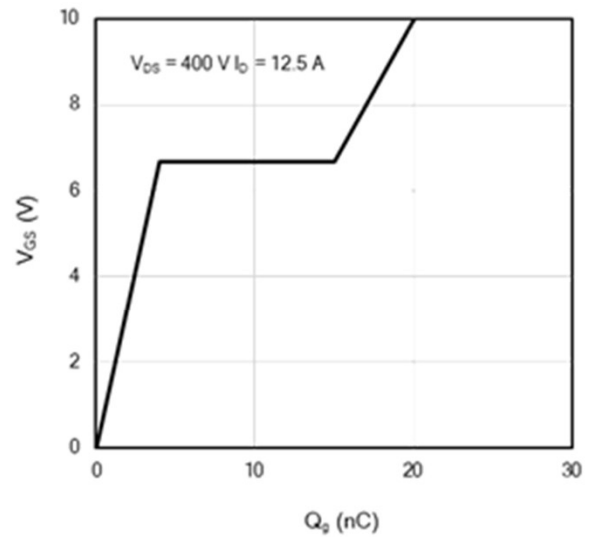


Figure 10: Gate-Charge Characteristics

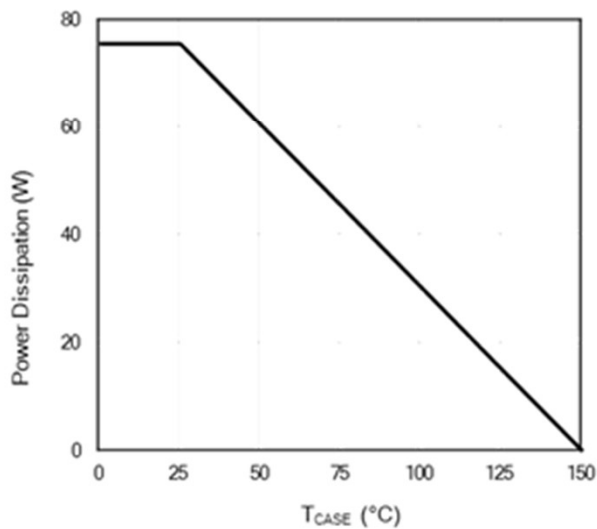


Figure 11: Power De-rating

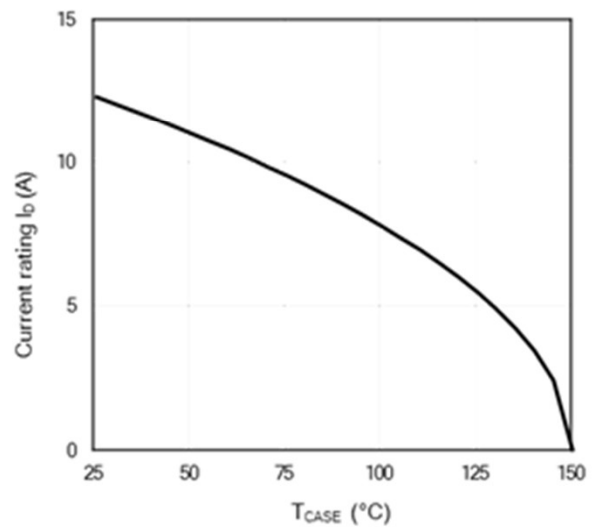


Figure 12: Current De-rating

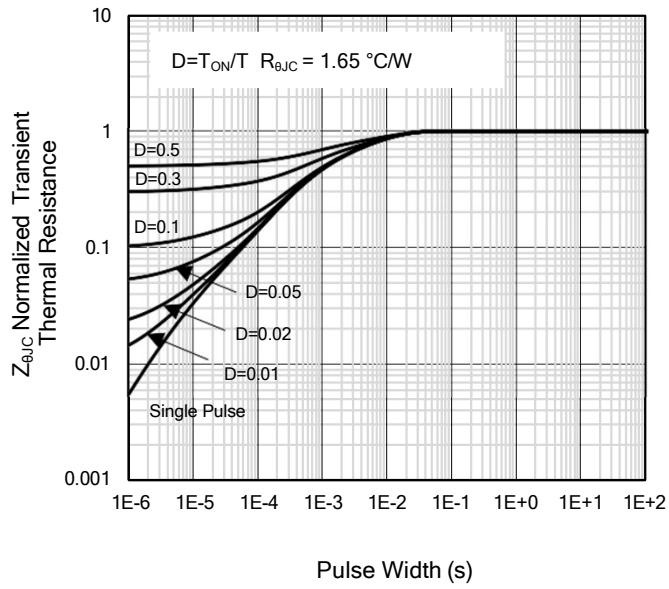


Figure 13: Normalized Maximum Transient Thermal Impedance

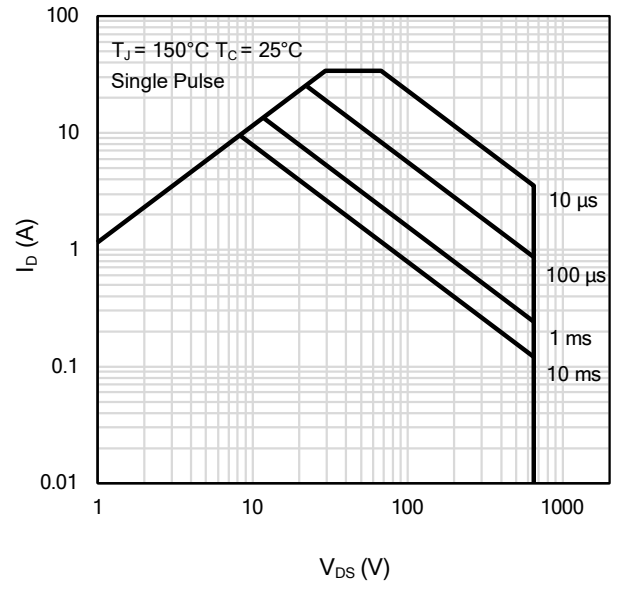
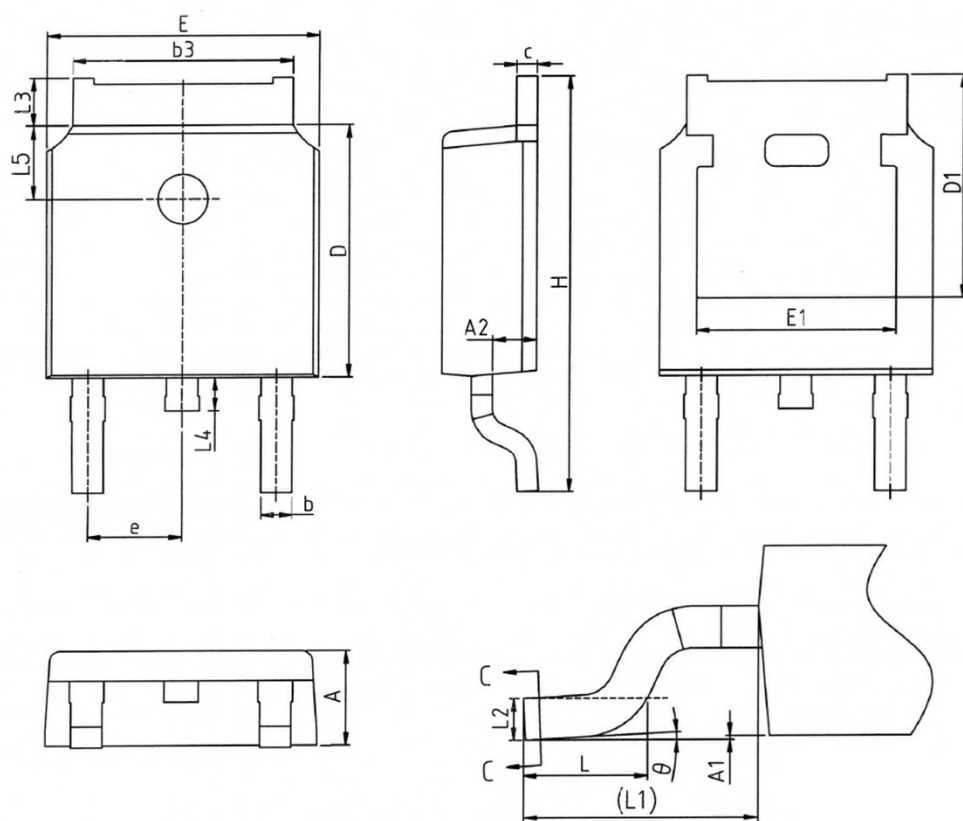


Figure 14: Maximum Forward Biased Safe Operating Area

## Package Outline: TO252 (DPAK)



### COMMON DIMENSIONS

| SYMBOL   | mm       |       |       |
|----------|----------|-------|-------|
|          | MIN      | NOM   | MAX   |
| A        | 2.20     | 2.30  | 2.38  |
| A1       | 0.00     | -     | 0.12  |
| A2       | 0.97     | 1.07  | 1.17  |
| b        | 0.68     | 0.78  | 0.90  |
| b3       | 5.20     | 5.33  | 5.46  |
| c        | 0.43     | 0.53  | 0.61  |
| D        | 5.98     | 6.10  | 6.22  |
| D1       | 5.30REF  |       |       |
| E        | 6.40     | 6.60  | 6.73  |
| E1       | 4.63     | -     | -     |
| e        | 2.286BSC |       |       |
| H        | 9.40     | 10.10 | 10.50 |
| L        | 1.38     | 1.50  | 1.75  |
| L1       | 2.90REF  |       |       |
| L2       | 0.51BSC  |       |       |
| L3       | 0.88     | -     | 1.28  |
| L4       | 0.50     | -     | 1.00  |
| L5       | 1.65     | 1.80  | 1.95  |
| $\theta$ | 0°       | -     | 8°    |

#### NOTES

1. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AA, DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

## Marking Information

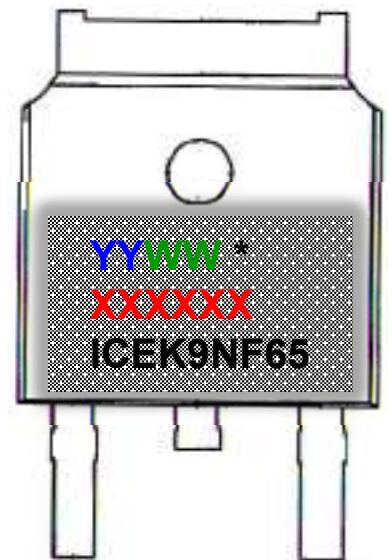
**YY** = Last two digits of the year

**WW** = Work week

**\*** = Site ID

**XXXXXX** = Lot ID

**ICEK9NF65** = ICE is IceMOS logo and  
K9NF65 is a designated device part  
number



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