

## Fast Switching EmCon Diode

### Feature

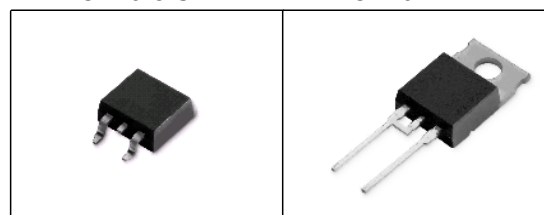
- 600 V EmCon technology
- Fast recovery
- Soft switching
- Low reverse recovery charge
- Low forward voltage
- 175°C operating temperature
- Easy paralleling

### Product Summary

|            |     |    |
|------------|-----|----|
| $V_{RRM}$  | 600 | V  |
| $I_F$      | 45  | A  |
| $V_F$      | 1.5 | V  |
| $T_{jmax}$ | 175 | °C |

P-TO220-3.SMD

P-TO220-2-2.



| Type     | Package       | Ordering Code | Marking | Pin 1 | PIN 2 | PIN 3 |
|----------|---------------|---------------|---------|-------|-------|-------|
| IDP45E60 | P-TO220-2-2.  | Q67040-S4469  | D45E60  | C     | A     | -     |
| IDB45E60 | P-TO220-3.SMD | Q67040-S4375  | D45E60  | NC    | C     | A     |

### Maximum Ratings, at $T_j = 25\text{ °C}$ , unless otherwise specified

| Parameter                                                  | Symbol         | Value      | Unit |
|------------------------------------------------------------|----------------|------------|------|
| Repetitive peak reverse voltage                            | $V_{RRM}$      | 600        | V    |
| Continuous forward current                                 | $I_F$          | 45         | A    |
| $T_C=25\text{ °C}$                                         |                | 71         |      |
| $T_C=90\text{ °C}$                                         |                | 47         |      |
| Surge non repetitive forward current                       | $I_{FSM}$      | 162        |      |
| $T_C=25\text{ °C}$ , $t_p=10\text{ ms}$ , sine halfwave    |                |            |      |
| Maximum repetitive forward current                         | $I_{FRM}$      | 111.5      |      |
| $T_C=25\text{ °C}$ , $t_p$ limited by $T_{jmax}$ , $D=0.5$ |                |            |      |
| Power dissipation                                          | $P_{tot}$      | 187        | W    |
| $T_C=25\text{ °C}$                                         |                | 106        |      |
| $T_C=90\text{ °C}$                                         |                |            |      |
| Operating and storage temperature                          | $T_j, T_{stg}$ | -55...+175 | °C   |
| Soldering temperature                                      | $T_S$          | 255        | °C   |
| 1.6mm(0.063 in.) from case for 10s                         |                |            |      |

**Thermal Characteristics**

| Parameter                                      | Symbol     | Values |      |      | Unit |
|------------------------------------------------|------------|--------|------|------|------|
|                                                |            | min.   | typ. | max. |      |
| Characteristics                                |            |        |      |      |      |
| Thermal resistance, junction - case            | $R_{thJC}$ | -      | -    | 0.8  | K/W  |
| Thermal resistance, junction - ambient, leaded | $R_{thJA}$ | -      | -    | 62   |      |
| SMD version, device on PCB:                    | $R_{thJA}$ |        |      |      |      |
| @ min. footprint                               |            | -      | -    | 62   |      |
| @ 6 cm <sup>2</sup> cooling area <sup>1)</sup> |            | -      | 35   | -    |      |

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

| Parameter                                  | Symbol | Values |      |      | Unit          |
|--------------------------------------------|--------|--------|------|------|---------------|
|                                            |        | min.   | typ. | max. |               |
| Static Characteristics                     |        |        |      |      |               |
| Reverse leakage current                    | $I_R$  |        |      |      | $\mu\text{A}$ |
| $V_R=600\text{V}, T_j=25^{\circ}\text{C}$  |        | -      | -    | 50   |               |
| $V_R=600\text{V}, T_j=150^{\circ}\text{C}$ |        | -      | -    | 3000 |               |
| Forward voltage drop                       | $V_F$  |        |      |      | V             |
| $I_F=45\text{A}, T_j=25^{\circ}\text{C}$   |        | -      | 1.5  | 2    |               |
| $I_F=45\text{A}, T_j=150^{\circ}\text{C}$  |        | -      | 1.5  | -    |               |

<sup>1)</sup> Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical without blown air.

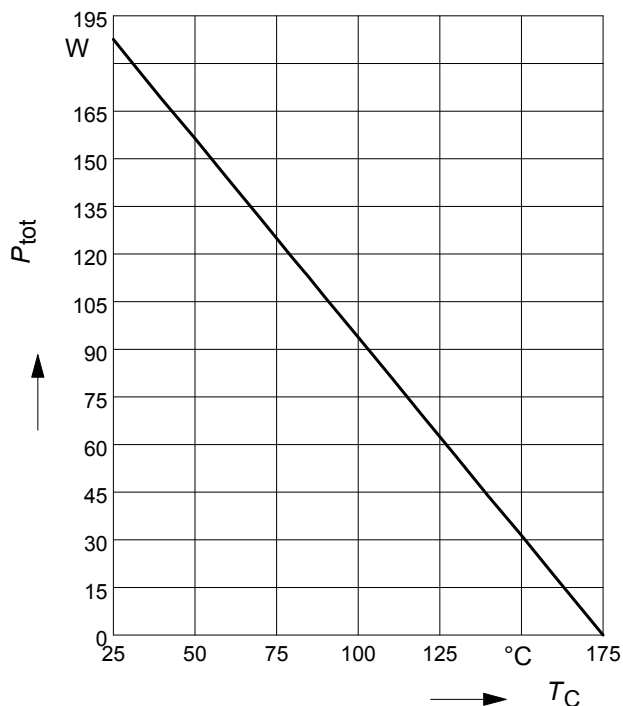
**Electrical Characteristics**, at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

| Parameter                                                                                                                                                                                                                                                | Symbol    | Values      |                      |             | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|----------------------|-------------|------|
|                                                                                                                                                                                                                                                          |           | min.        | typ.                 | max.        |      |
| Dynamic Characteristics                                                                                                                                                                                                                                  |           |             |                      |             |      |
| Reverse recovery time<br><br>$V_R=400V$ , $I_F=45A$ , $di_F/dt=1000A/\mu s$ , $T_j=25^{\circ}C$<br>$V_R=400V$ , $I_F=45A$ , $di_F/dt=1000A/\mu s$ , $T_j=125^{\circ}C$<br>$V_R=400V$ , $I_F=45A$ , $di_F/dt=1000A/\mu s$ , $T_j=150^{\circ}C$            | $t_{rr}$  | -<br>-<br>- | 140<br>185<br>195    | -<br>-<br>- | ns   |
| Peak reverse current<br><br>$V_R=400V$ , $I_F = 45A$ , $di_F/dt=1000A/\mu s$ , $T_j=25^{\circ}C$<br>$V_R=400V$ , $I_F = 45A$ , $di_F/dt=1000A/\mu s$ , $T_j=125^{\circ}C$<br>$V_R=400V$ , $I_F = 45A$ , $di_F/dt=1000A/\mu s$ , $T_j=150^{\circ}C$       | $I_{rrm}$ | -<br>-<br>- | 23<br>28.1<br>29     | -<br>-<br>- | A    |
| Reverse recovery charge<br><br>$V_R=400V$ , $I_F=45A$ , $di_F/dt=1000A/\mu s$ , $T_j=25^{\circ}C$<br>$V_R=400V$ , $I_F = 45A$ , $di_F/dt=1000A/\mu s$ , $T_j=125^{\circ}C$<br>$V_R=400V$ , $I_F = 45A$ , $di_F/dt=1000A/\mu s$ , $T_j=150^{\circ}C$      | $Q_{rr}$  | -<br>-<br>- | 1400<br>2650<br>2900 | -<br>-<br>- | nC   |
| Reverse recovery softness factor<br><br>$V_R=400V$ , $I_F=45A$ , $di_F/dt=1000A/\mu s$ , $T_j=25^{\circ}C$<br>$V_R=400V$ , $I_F=45A$ , $di_F/dt=1000A/\mu s$ , $T_j=125^{\circ}C$<br>$V_R=400V$ , $I_F=45A$ , $di_F/dt=1000A/\mu s$ , $T_j=150^{\circ}C$ | S         | -<br>-<br>- | 3.1<br>4.2<br>4.4    | -<br>-<br>- |      |

## 1 Power dissipation

$$P_{\text{tot}} = f(T_C)$$

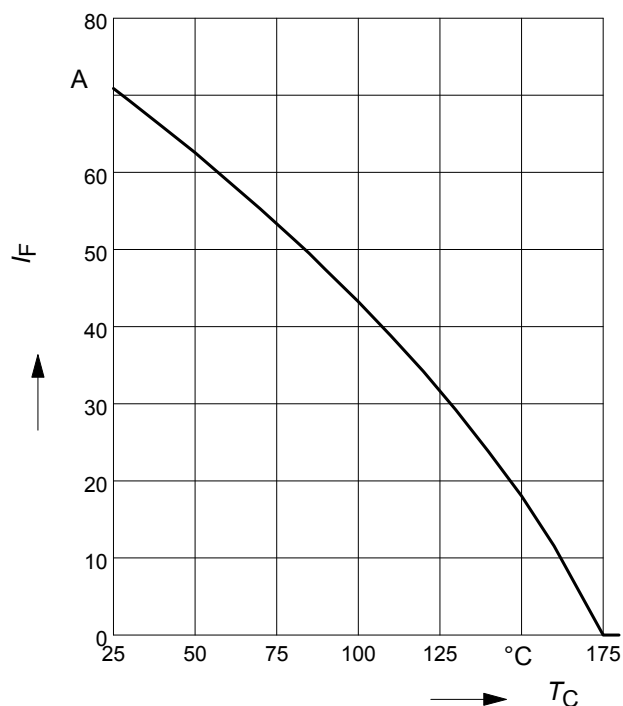
parameter:  $T_j \leq 175^\circ\text{C}$



## 2 Diode forward current

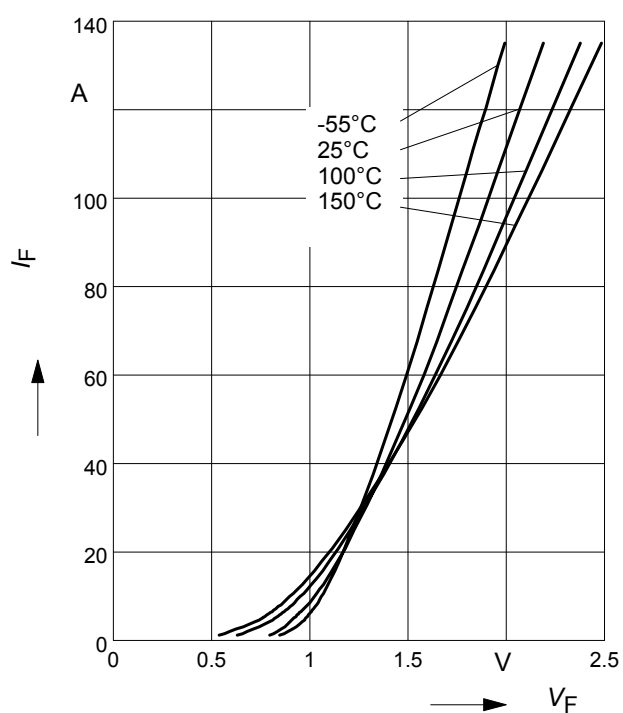
$$I_F = f(T_C)$$

parameter:  $T_j \leq 175^\circ\text{C}$



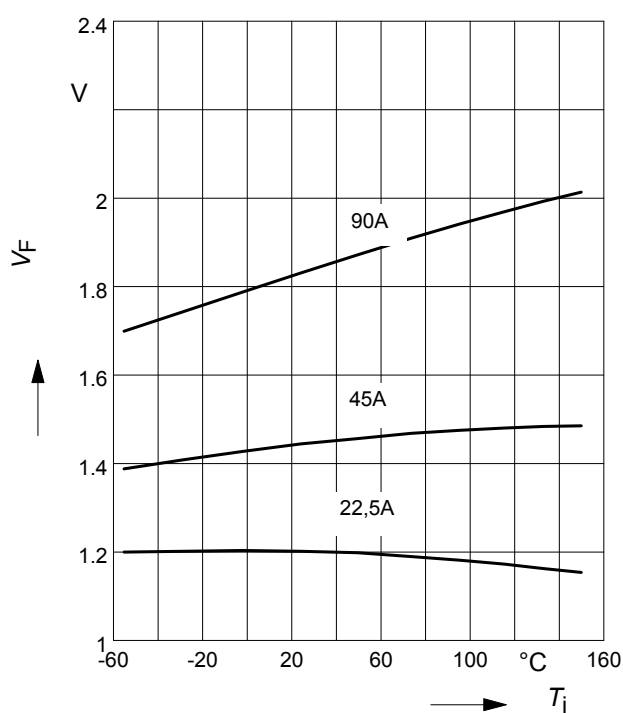
## 3 Typ. diode forward current

$$I_F = f(V_F)$$



## 4 Typ. diode forward voltage

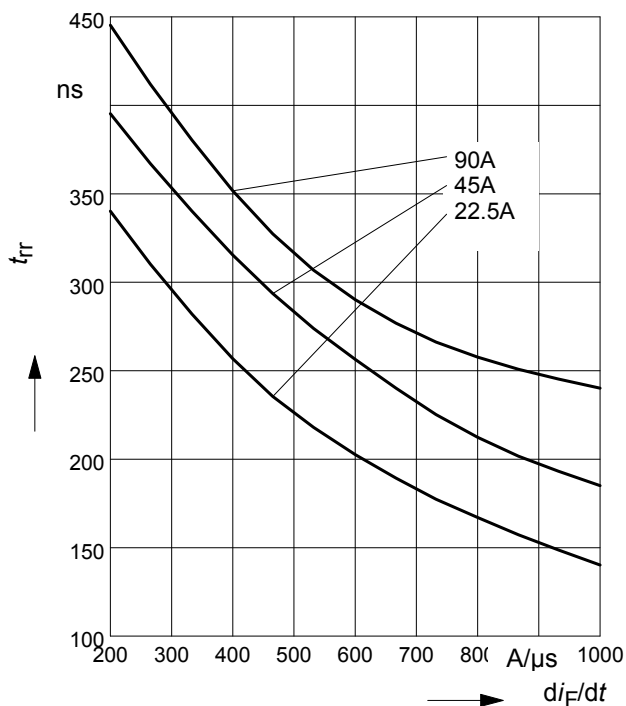
$$V_F = f(T_j)$$



### 5 Typ. reverse recovery time

$$t_{rr} = f(dI_F/dt)$$

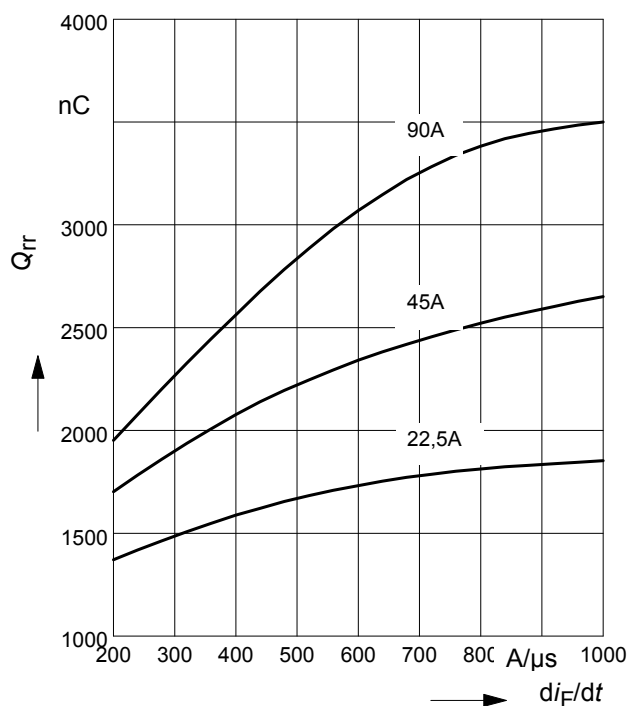
parameter:  $V_R = 400V$ ,  $T_j = 125^\circ C$



### 6 Typ. reverse recovery charge

$$Q_{rr} = f(dI_F/dt)$$

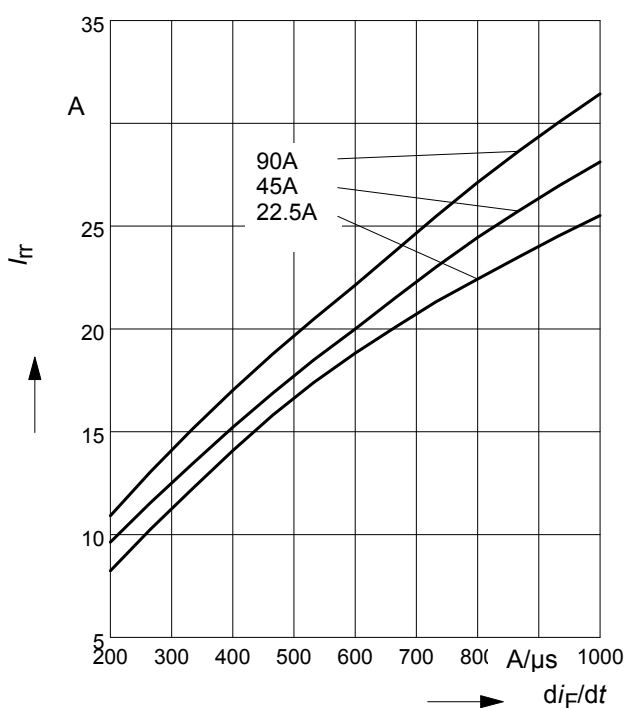
parameter:  $V_R = 400V$ ,  $T_j = 125^\circ C$



### 7 Typ. reverse recovery current

$$I_{rr} = f(dI_F/dt)$$

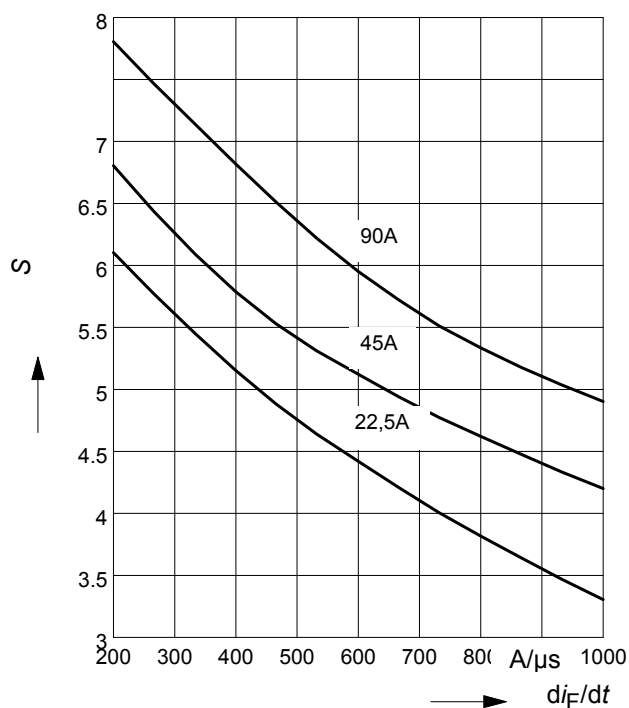
parameter:  $V_R = 400V$ ,  $T_j = 125^\circ C$



### 8 Typ. reverse recovery softness factor

$$S = f(dI_F/dt)$$

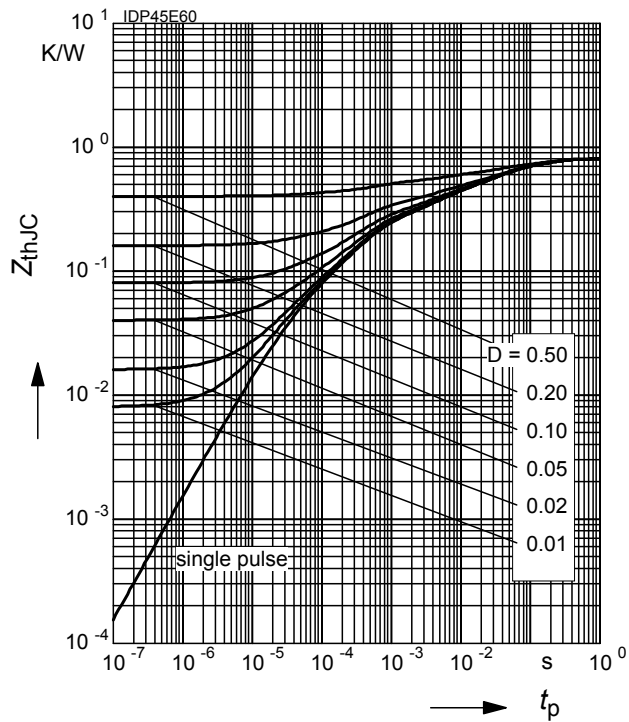
parameter:  $V_R = 400V$ ,  $T_j = 125^\circ C$



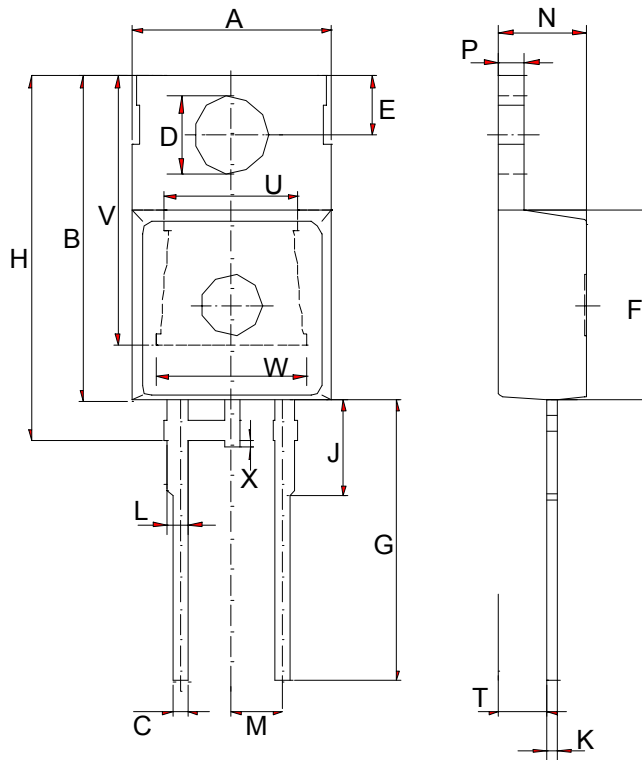
## 9 Max. transient thermal impedance

$$Z_{thJC} = f(t_p)$$

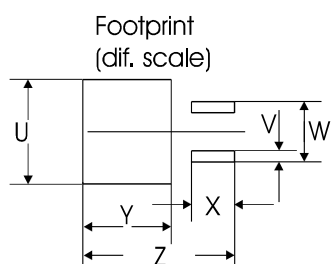
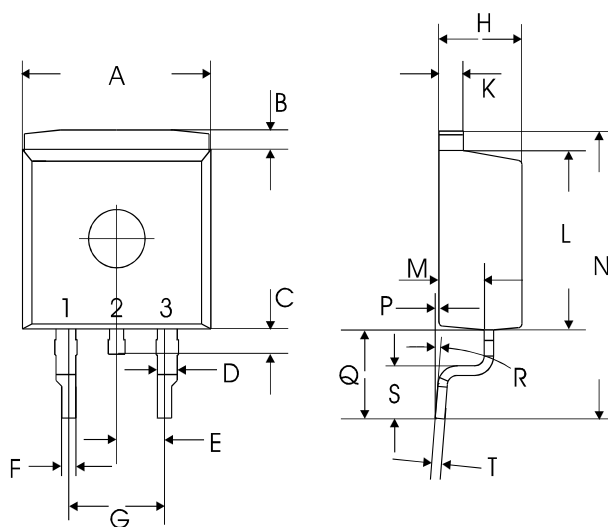
parameter :  $D = t_p/T$



TO-220-2-2



| symbol | dimensions |       |            |        |
|--------|------------|-------|------------|--------|
|        | [mm]       |       | [inch]     |        |
|        | min        | max   | min        | max    |
| A      | 9.70       | 10.10 | 0.3819     | 0.3976 |
| B      | 15.30      | 15.90 | 0.6024     | 0.6260 |
| C      | 0.65       | 0.85  | 0.0256     | 0.0335 |
| D      | 3.55       | 3.85  | 0.1398     | 0.1516 |
| E      | 2.60       | 3.00  | 0.1024     | 0.1181 |
| F      | 9.00       | 9.40  | 0.3543     | 0.3701 |
| G      | 13.00      | 14.00 | 0.5118     | 0.5512 |
| H      | 17.20      | 17.80 | 0.6772     | 0.7008 |
| J      | 4.40       | 4.80  | 0.1732     | 0.1890 |
| K      | 0.40       | 0.60  | 0.0157     | 0.0236 |
| L      | 1.05 typ.  |       | 0.41 typ.  |        |
| M      | 2.54 typ.  |       | 0.1 typ.   |        |
| N      | 4.4 typ.   |       | 0.173 typ. |        |
| P      | 1.10       | 1.40  | 0.0433     | 0.0551 |
| T      | 2.4 typ.   |       | 0.095 typ. |        |
| U      | 6.6 typ.   |       | 0.26 typ.  |        |
| V      | 13.0 typ.  |       | 0.51 typ.  |        |
| W      | 7.5 typ.   |       | 0.295 typ. |        |
| X      | 0.00       | 0.40  | 0.0000     | 0.0157 |



TO-220-3-45 (P-TO220SMD)

| symbol | dimensions |       |             |        |
|--------|------------|-------|-------------|--------|
|        | [mm]       |       | [inch]      |        |
|        | min        | max   | min         | max    |
| A      | 9.80       | 10.00 | 0.3858      | 0.3937 |
| B      | 1.3 typ.   |       | 0.0512 typ. |        |
| C      | 1.25       | 1.75  | 0.0492      | 0.0689 |
| D      | 0.95       | 1.15  | 0.0374      | 0.0453 |
| E      | 2.54 typ.  |       | 0.1 typ.    |        |
| F      | 0.72       | 0.85  | 0.0283      | 0.0335 |
| G      | 5.08 typ.  |       | 0.2 typ.    |        |
| H      | 4.30       | 4.50  | 0.1693      | 0.1772 |
| K      | 1.28       | 1.40  | 0.0504      | 0.0551 |
| L      | 9.00       | 9.40  | 0.3543      | 0.3701 |
| M      | 2.30       | 2.50  | 0.0906      | 0.0984 |
| N      | 14.1 typ.  |       | 0.5551 typ. |        |
| P      | 0.00       | 0.20  | 0.0000      | 0.0079 |
| Q      | 3.30       | 3.90  | 0.1299      | 0.1535 |
| R      | 8° max     |       | 8° max      |        |
| S      | 1.70       | 2.50  | 0.0669      | 0.0984 |
| T      | 0.50       | 0.65  | 0.0197      | 0.0256 |
| U      | 10.8 typ.  |       | 0.4252 typ. |        |
| V      | 1.35 typ.  |       | 0.0532 typ. |        |
| W      | 6.43 typ.  |       | 0.2532 typ. |        |
| X      | 4.60 typ.  |       | 0.1811 typ. |        |
| Y      | 9.40 typ.  |       | 0.3701 typ. |        |
| Z      | 16.15 typ. |       | 0.6358 typ. |        |

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