RoHS compliant

# N-CHANNEL MOSFET

***Qualified per MIL-PRF-19500/556***

*Qualified Levels: JAN, JANTX, and JANTXV*

## DESCRIPTION

This family of 2N6782U, 2N6784U and 2N6786U switching transistors are military qualified up to the JANTXV level for high-reliability applications. These devices are also available in thru hole TO-205AF package. Microsemi also offers numerous other transistor products to meet higher and lower power ratings with various switching speed requirements in both through-hole and surface-mount packages.

**Important:** For the latest information, visit our website http://www.microsemi.com.

**U-18 LCC Package**

Also available in:

**TO-205AF (TO-39) package**
(leaded)
**2N6782 & 2N6786**

## FEATURES

- Surface mount equivalent of JEDEC registered 2N6782, 2N6784 and 2N6786 number series.
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/556. (See part nomenclature for all available options.)
- RoHS compliant by design.

## APPLICATIONS / BENEFITS

- Lightweight surface mount design enables mounting in a crowded area.
- Military and other high-reliability applications.

## MAXIMUM RATINGS @ $T_A$ = +25 ºC unless otherwise stated

| Parameters / Test Conditions | | Symbol | Value | Unit |
|---|---|---|---|---|
| Operating & Storage Junction Temperature Range | | $T_J$ & $T_{stg}$ | -55 to +150 | °C |
| Thermal Resistance Junction-to-Case | | $R_{\Theta JC}$ | 8.33 | °C/W |
| Total Power Dissipation | @ $T_A$ = +25 °C<br>@ $T_C$ = +25 °C (1) | $P_T$ | 0.8<br>15 | W |
| Drain-Source Voltage, dc | 2N6782U<br>2N6784U<br>2N6786U | $V_{DS}$ | 100<br>200<br>400 | V |
| Gate-Source Voltage, dc | | $V_{GS}$ | ± 20 | V |
| Drain Current, dc @ $T_C$ = +25 ºC (2) | 2N6782U<br>2N6784U<br>2N6786U | $I_{D1}$ | 3.50<br>2.25<br>1.25 | A |
| Drain Current, dc @ $T_C$ = +100 ºC (2) | 2N6782U<br>2N6784U<br>2N6786U | $I_{D2}$ | 2.25<br>1.50<br>0.80 | A |
| Off-State Current (Peak Total Value) (3) | 2N6782U<br>2N6784U<br>2N6786U | $I_{DM}$ | 14.0<br>9.0<br>5.5 | A (pk) |
| Source Current | 2N6782U<br>2N6784U<br>2N6786U | $I_S$ | 3.50<br>2.25<br>1.25 | A |

*See notes on next page.*

**MSC – Lawrence**
6 Lake Street,
Lawrence, MA 01841
Tel: 1-800-446-1158 or
(978) 620-2600
Fax: (978) 689-0803

**MSC – Ireland**
Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

**Website:**
www.microsemi.com

**Notes:** 1. Derate linearly 0.12 W/°C for $T_C$ > +25 °C.

2. The following formula derives the maximum theoretical $I_D$ limit. $I_D$ is also limited by package and internal wires and may be limited due to pin diameter.

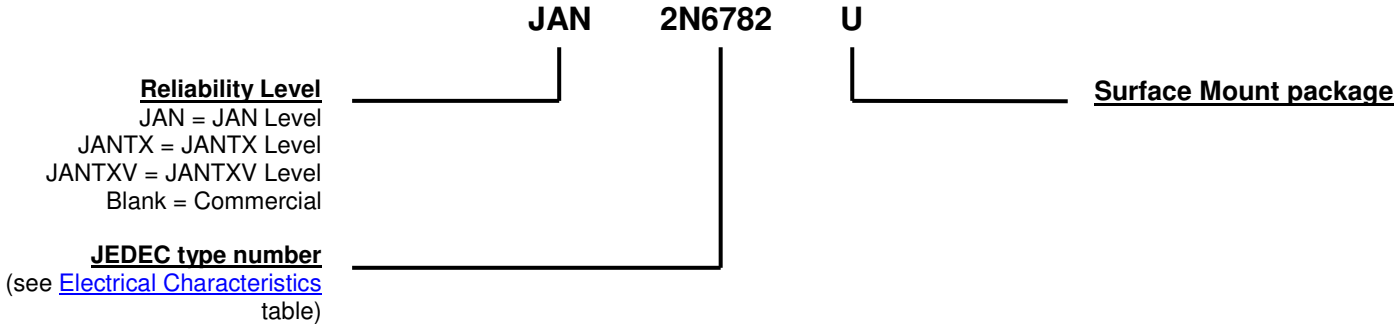
$$I_D = \sqrt{\frac{T_J(max) - T_C}{R_{\theta JC} \times R_{DS(on)} @ T_J(max)}}$$

3. $I_{DM}$ = 4 x $I_{D1}$ as calculated in note 1.

## MECHANICAL and PACKAGING

- CASE: Ceramic LCC-18 with kovar gold plated lid.
- TERMINALS: Gold plating over nickel.
- MARKING: Manufacturer's ID, part number, date code, ESD symbol at Pin 1 location.
- TAPE & REEL option: Standard per EIA-481-D. Consult factory for quantities.
- See Package Dimensions on last page.

## PART NOMENCLATURE




## SYMBOLS & DEFINITIONS

| Symbol | Definition |
|---|---|
| di/dt | Rate of change of diode current while in reverse-recovery mode, recorded as maximum value. |
| $I_F$ | Forward current |
| $R_G$ | Gate drive impedance |
| $V_{DD}$ | Drain supply voltage |
| $V_{DS}$ | Drain source voltage, dc |
| $V_{GS}$ | Gate source voltage, dc |

**ELECTRICAL CHARACTERISTICS** @ $T_A$ = +25 °C, unless otherwise noted

| Parameters / Test Conditions | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Drain-Source Breakdown Voltage | | | | | |
| $V_{GS}$ = 0 V, $I_D$ = 1.0 mA | 2N6782U<br>2N6784U<br>2N6786U | $V_{(BR)DSS}$ | 100<br>200<br>400 | | V |
| Gate-Source Voltage (Threshold) | | | | | |
| $V_{DS} \geq V_{GS}$, $I_D$ = 0.25 mA | | $V_{GS(th)1}$ | 2.0 | 4.0 | V |
| $V_{DS} \geq V_{GS}$, $I_D$ = 0.25 mA, $T_J$ = +125 °C | | $V_{GS(th)2}$ | 1.0 | | |
| $V_{DS} \geq V_{GS}$, $I_D$ = 0.25 mA, $T_J$ = -55 °C | | $V_{GS(th)3}$ | | 5.0 | |
| Gate Current | | | | | |
| $V_{GS}$ = ± 20 V, $V_{DS}$ = 0 V | | $I_{GSS1}$ | | ±100 | nA |
| $V_{GS}$ = ± 20 V, $V_{DS}$ = 0 V, $T_J$ = +125 °C | | $I_{GSS2}$ | | ±200 | |
| Drain Current | | | | | |
| $V_{GS}$ = 0 V, $V_{DS}$ = 80 V | 2N6782U | | | | |
| $V_{GS}$ = 0 V, $V_{DS}$ = 160 V | 2N6784U | $I_{DSS1}$ | | 25 | µA |
| $V_{GS}$ = 0 V, $V_{DS}$ = 320 V | 2N6786U | | | | |
| Drain Current | | | | | |
| $V_{GS}$ = 0 V, $V_{DS}$ = 80 V, $T_J$ = +125 °C | 2N6782U | | | | |
| $V_{GS}$ = 0 V, $V_{DS}$ = 160 V, $T_J$ = +125 °C | 2N6784U | $I_{DSS2}$ | | 0.25 | mA |
| $V_{GS}$ = 0 V, $V_{DS}$ = 320 V, $T_J$ = +125 °C | 2N6786U | | | | |
| Static Drain-Source On-State Resistance | | | | | |
| $V_{GS}$ = 10 V, $I_D$ = 2.25 A pulsed | 2N6782U | | | 0.60 | |
| $V_{GS}$ = 10 V, $I_D$ = 1.50 A pulsed | 2N6784U | $r_{DS(on)1}$ | | 1.50 | Ω |
| $V_{GS}$ = 10 V, $I_D$ = 0.80 A pulsed | 2N6786U | | | 3.60 | |
| Static Drain-Source On-State Resistance | | | | | |
| $V_{GS}$ = 10 V, $I_D$ = 3.50 A pulsed | 2N6782U | | | 0.61 | |
| $V_{GS}$ = 10 V, $I_D$ = 2.25 A pulsed | 2N6784U | $r_{DS(on)2}$ | | 1.60 | Ω |
| $V_{GS}$ = 10 V, $I_D$ = 1.25 A pulsed | 2N6786U | | | 3.70 | |
| Static Drain-Source On-State Resistance | | | | | |
| $T_J$ = +125 °C | | | | | |
| $V_{GS}$ = 10 V, $I_D$ = 2.25 A pulsed | 2N6782U | | | 1.08 | |
| $V_{GS}$ = 10 V, $I_D$ = 1.50 A pulsed | 2N6784U | $r_{DS(on)3}$ | | 2.81 | Ω |
| $V_{GS}$ = 10 V, $I_D$ = 0.80 A pulsed | 2N6786U | | | 7.92 | |
| Diode Forward Voltage | | | | | |
| $V_{GS}$ = 0 V, $I_D$ = 3.50 A pulsed | 2N6782U | | | 1.5 | |
| $V_{GS}$ = 0 V, $I_D$ = 2.25 A pulsed | 2N6784U | $V_{SD}$ | | 1.5 | V |
| $V_{GS}$ = 0 V, $I_D$ = 1.25 A pulsed | 2N6786U | | | 1.4 | |

**ELECTRICAL CHARACTERISTICS** @ $T_A$ = +25 °C, unless otherwise noted (continued)

## DYNAMIC CHARACTERISTICS

| Parameters / Test Conditions | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Gate Charge: | | | | | |
| On-State Gate Charge | | | | | |
| $V_{GS}$ = 10 V, $I_D$ = 3.50 A, $V_{DS}$ = 50 V | 2N6782U | $Q_{g(on)}$ | | 8.1 | nC |
| $V_{GS}$ = 10 V, $I_D$ = 2.25 A, $V_{DS}$ = 100 V | 2N6784U | | | 8.6 | |
| $V_{GS}$ = 10 V, $I_D$ = 1.25 A, $V_{DS}$ = 200 V | 2N6786U | | | 12 | |
| Gate to Source Charge | | | | | |
| $V_{GS}$ = 10 V, $I_D$ = 3.50 A, $V_{DS}$ = 50 V | 2N6782U | $Q_{gs}$ | | 1.7 | nC |
| $V_{GS}$ = 10 V, $I_D$ = 2.25 A, $V_{DS}$ = 100 V | 2N6784U | | | 1.5 | |
| $V_{GS}$ = 10 V, $I_D$ = 1.25 A, $V_{DS}$ = 200 V | 2N6786U | | | 1.8 | |
| Gate to Drain Charge | | | | | |
| $V_{GS}$ = 10 V, $I_D$ = 3.50 A, $V_{DS}$ = 50 V | 2N6782U | $Q_{gd}$ | | 4.5 | nC |
| $V_{GS}$ = 10 V, $I_D$ = 2.25 A, $V_{DS}$ = 100 V | 2N6784U | | | 5.5 | |
| $V_{GS}$ = 10 V, $I_D$ = 1.25 A, $V_{DS}$ = 200 V | 2N6786U | | | 7.6 | |

## SWITCHING CHARACTERISTICS

| Parameters / Test Conditions | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Turn-on delay time | | | | | |
| $I_D$ = 3.50 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 50 V | 2N6782U | $t_{d(on)}$ | | 15 | ns |
| $I_D$ = 2.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 100 V | 2N6784U | | | | |
| $I_D$ = 1.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 200 V | 2N6786U | | | | |
| Rinse time | | | | | |
| $I_D$ = 3.50 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 50 V | 2N6782U | $t_r$ | | 25 | ns |
| $I_D$ = 2.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 100 V | 2N6784U | | | 20 | |
| $I_D$ = 1.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 200 V | 2N6786U | | | 20 | |
| Turn-off delay time | | | | | |
| $I_D$ = 3.50 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 50 V | 2N6782U | $t_{d(off)}$ | | 25 | ns |
| $I_D$ = 2.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 100 V | 2N6784U | | | 30 | |
| $I_D$ = 1.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 200 V | 2N6786U | | | 35 | |
| Fall time | | | | | |
| $I_D$ = 3.50 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 50 V | 2N6782U | $t_f$ | | 20 | ns |
| $I_D$ = 2.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 100 V | 2N6784U | | | 20 | |
| $I_D$ = 1.25 A, $V_{GS}$ = 10 V, $R_G$ = 7.5 Ω, $V_{DD}$ = 200 V | 2N6786U | | | 30 | |
| Diode Reverse Recovery Time | | | | | |
| di/dt ≤ 100 A/µs, $V_{DD}$ ≤ 50 V, $I_F$ = 3.50 A | 2N6782U | $t_{rr}$ | | 180 | ns |
| di/dt ≤ 100 A/µs, $V_{DD}$ ≤ 50 V, $I_F$ = 2.25 A | 2N6784U | | | 350 | |
| di/dt ≤ 100 A/µs, $V_{DD}$ ≤ 50 V, $I_F$ = 1.25 A | 2N6786U | | | 540 | |

## GRAPHS

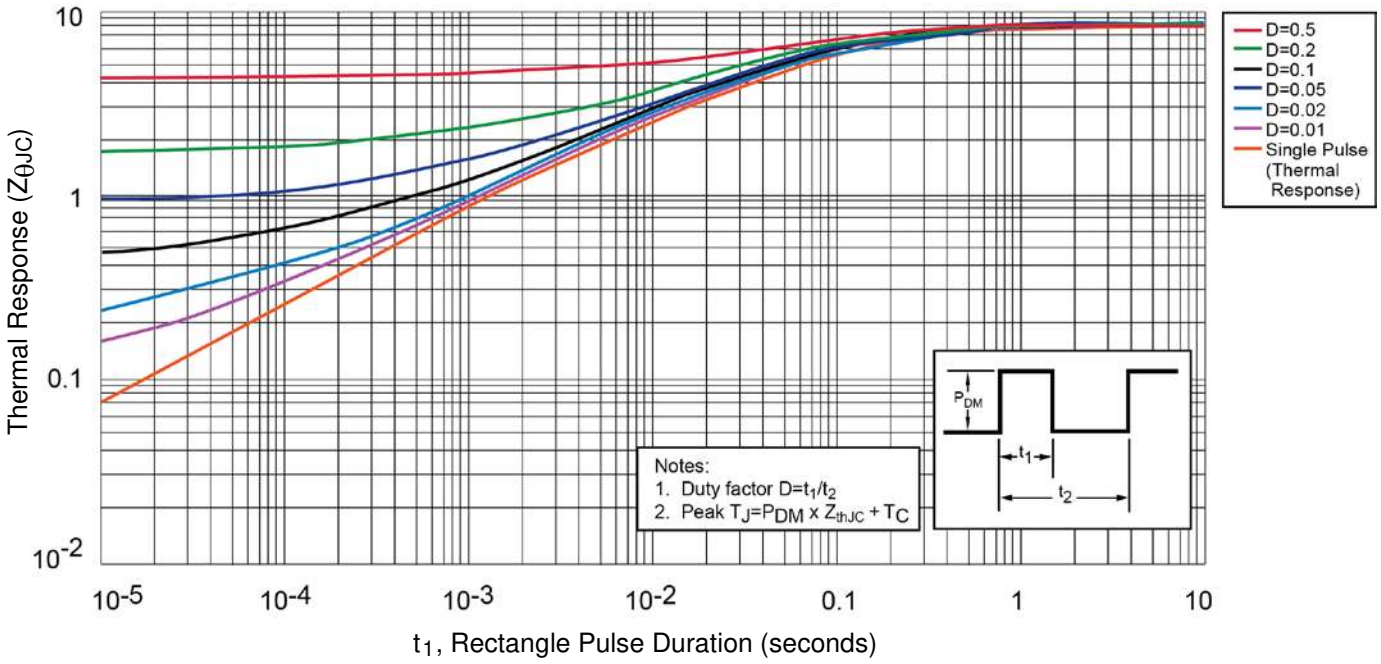
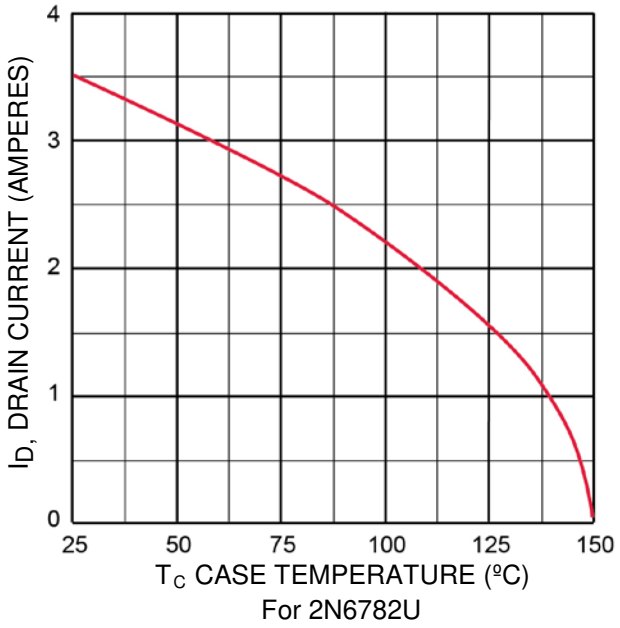


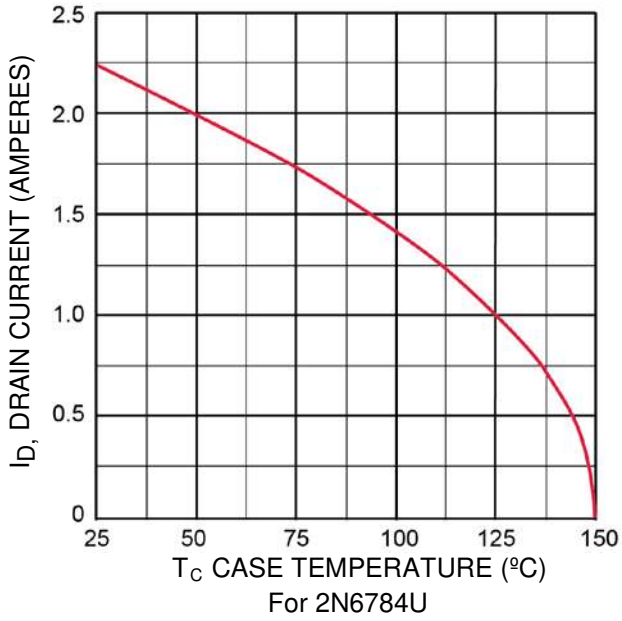

**FIGURE 1**
Thermal Response Curves

## GRAPHS (continued)

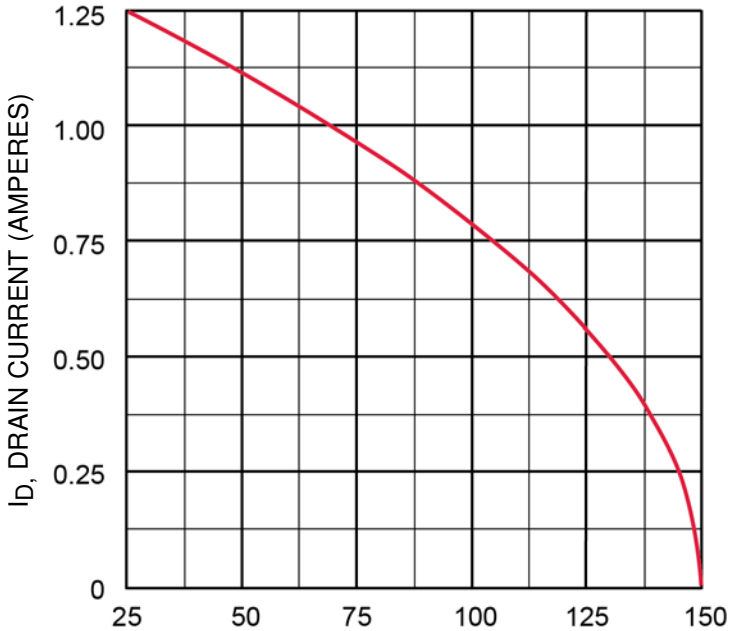
**FIGURE 2** – Maximum Drain Current vs Case Temperature Graphs




For 2N6782U



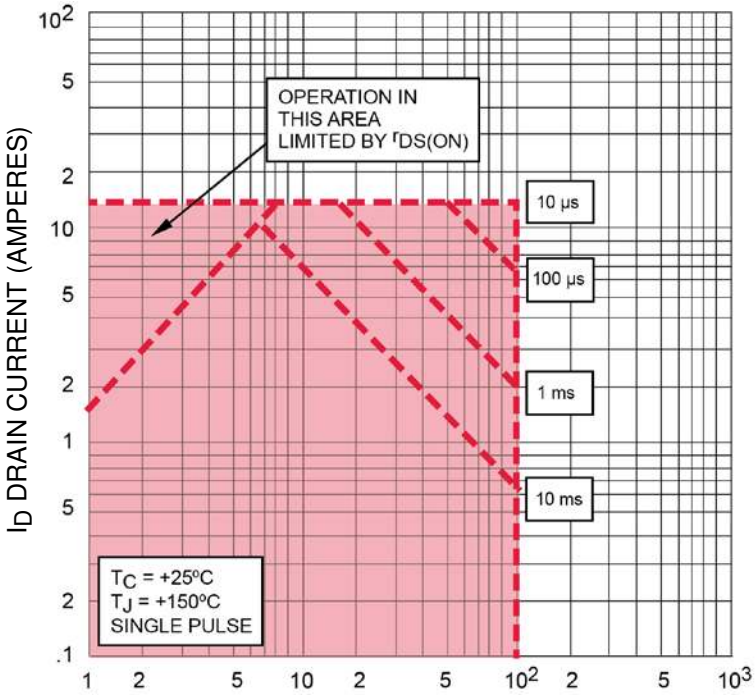

For 2N6784U

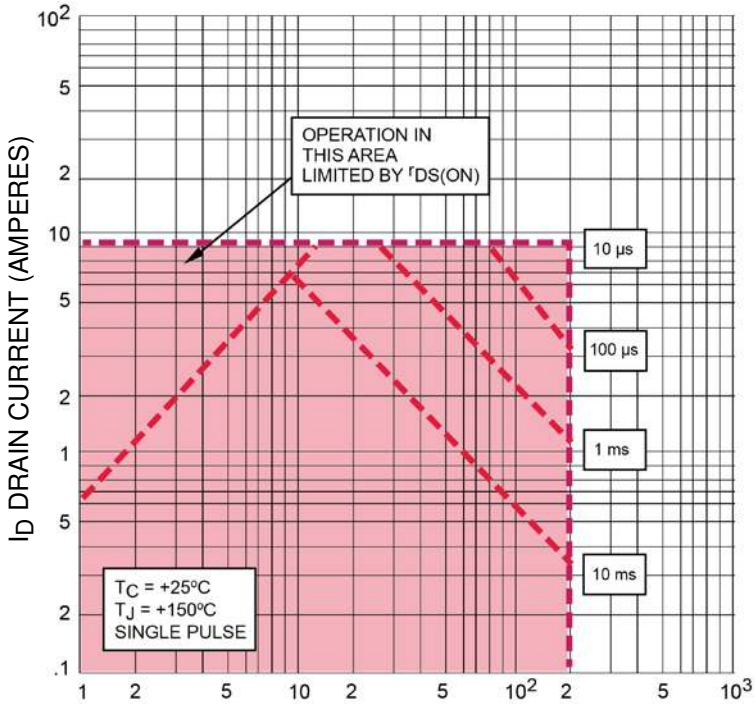



For 2N6786U

## GRAPHS (continued)

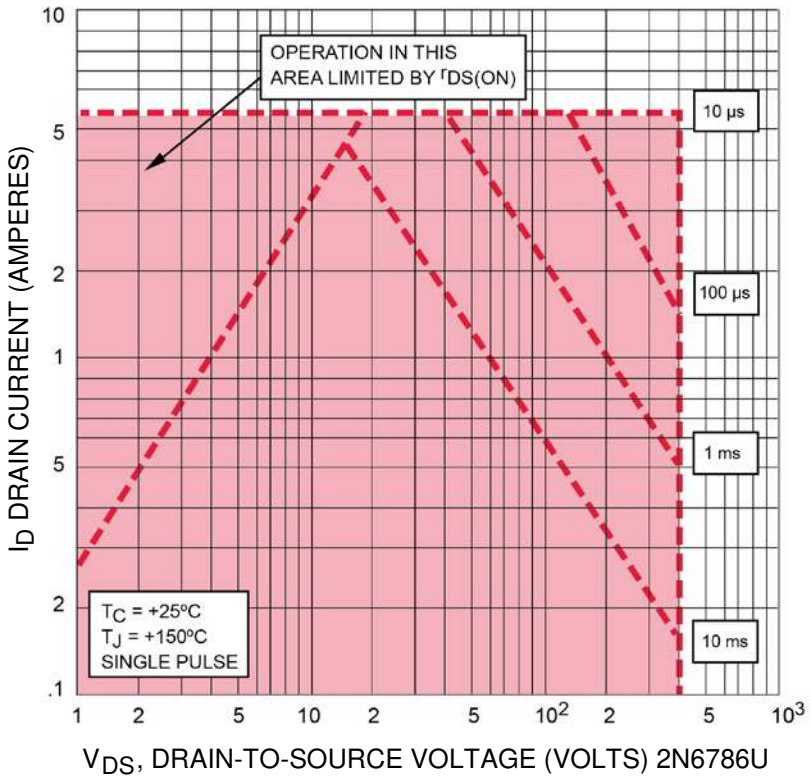
**FIGURE 3** – Maximum Safe Operating Area



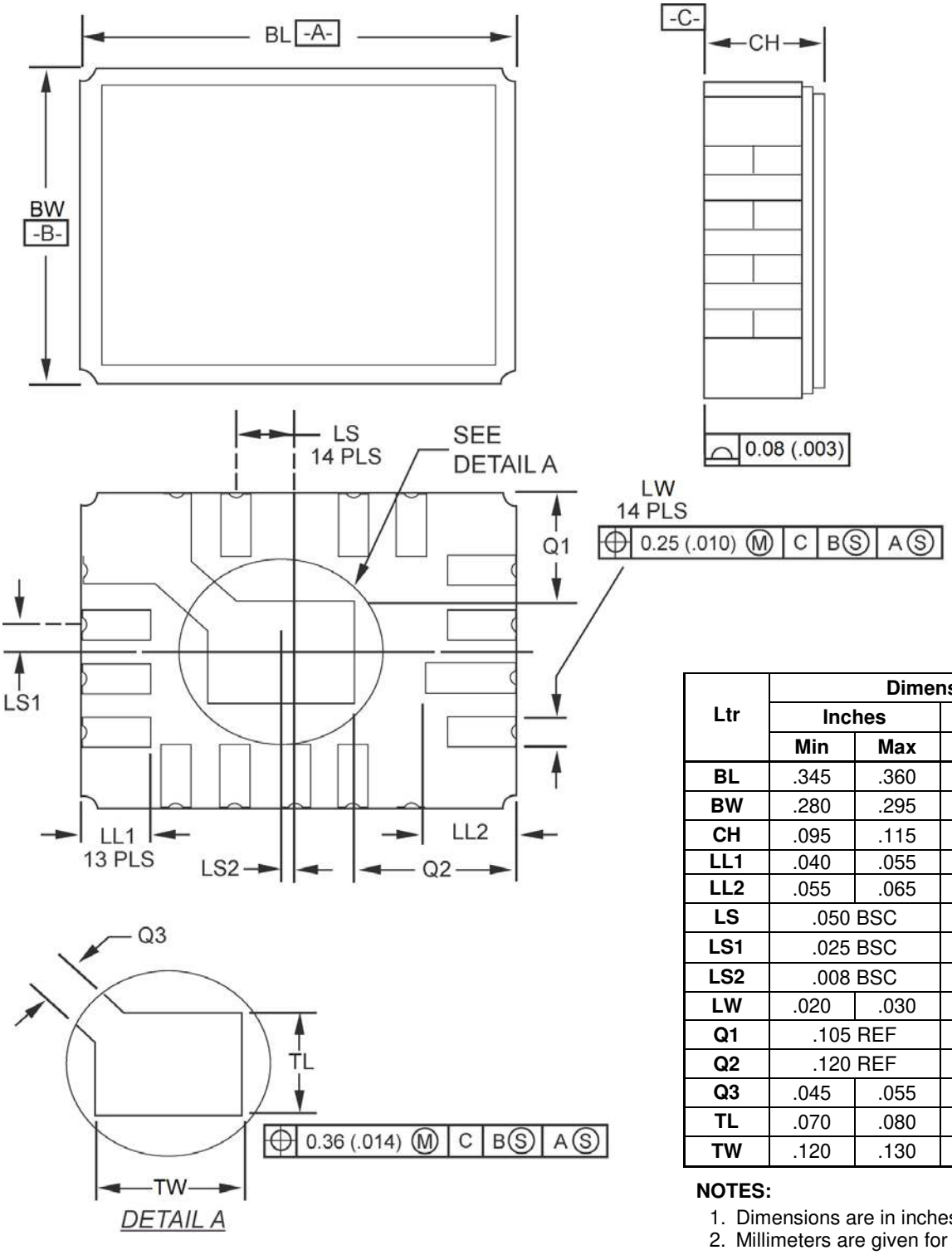



## GRAPHS (continued)

**FIGURE 3** – Maximum Safe Operating Area



## PACKAGE DIMENSIONS

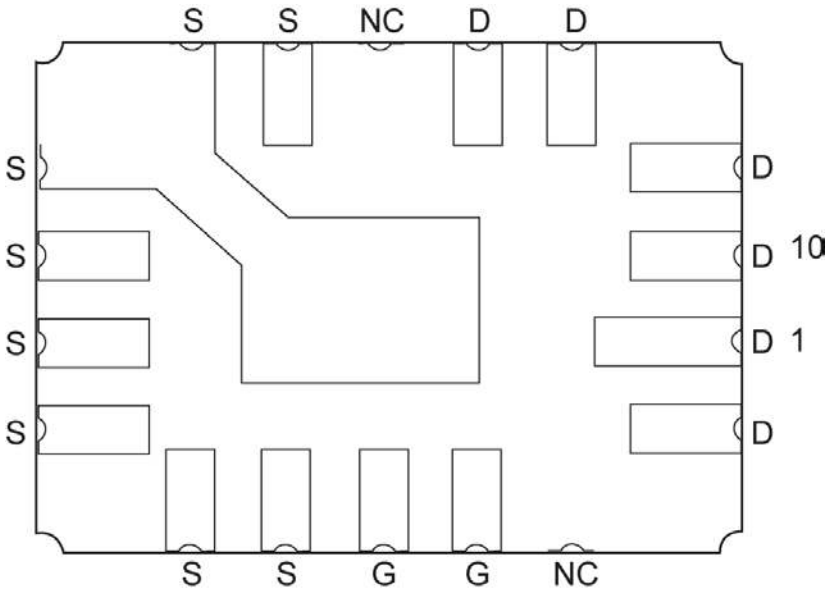



| Ltr | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| BL | .345 | .360 | 8.77 | 9.14 |
| BW | .280 | .295 | 7.12 | 7.49 |
| CH | .095 | .115 | 2.42 | 2.92 |
| LL1 | .040 | .055 | 1.02 | 1.39 |
| LL2 | .055 | .065 | 1.40 | 1.65 |
| LS | .050 BSC | | 1.27 BSC | |
| LS1 | .025 BSC | | 0.635 BSC | |
| LS2 | .008 BSC | | 0.203 BSC | |
| LW | .020 | .030 | 0.51 | 0.76 |
| Q1 | .105 REF | | 2.67 REF | |
| Q2 | .120 REF | | 3.05 REF | |
| Q3 | .045 | .055 | 1.14 | 1.40 |
| TL | .070 | .080 | 1.78 | 2.03 |
| TW | .120 | .130 | 3.05 | 3.30 |

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
4. Ceramic package only.

## PAD LAYOUT




**PAD ASSIGNMENTS**