The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF

Data Sheet No. PD60299

International
IOR Rectifier

# IRS212(7, 71, 8, 81)(S)PbF

## CURRENT SENSING SINGLE CHANNEL DRIVER

### Features

- Floating channel designed for bootstrap operation
  Fully operational to +600 V
  Tolerant to negative transient voltage dV/dt immune
- Application-specific gate drive range:
  Motor Drive: 12 V to 20 V (IRS2127/IRS2128)
  Automotive: 9 V to 20 V (IRS21271/IRS21281)
- Undervoltage lockout
- 3.3 V, 5 V, and 15 V input logic compatible
- $\overline{\text{FAULT}}$ lead indicates shutdown has occured
- Output in phase with input (IRS2127/IRS21271)
- Output out of phase with input (IRS2128/IRS21281)
- RoHS compliant

### Product Summary

| | | |
|---|---|---|
| $V_{OFFSET}$ | 600 V max. | |
| $I_O$+/- | 200 mA / 420 mA | |
| $V_{OUT}$ | 12 V - 20V (IRS2127/IR2128) | 9 V - 20 V (IRS21271/IR21281) |
| $V_{CSth}$ | 250 mV or 1.8 V | |
| $t_{on/off}$ (typ.) | 150 ns & 150 ns | |

### Packages

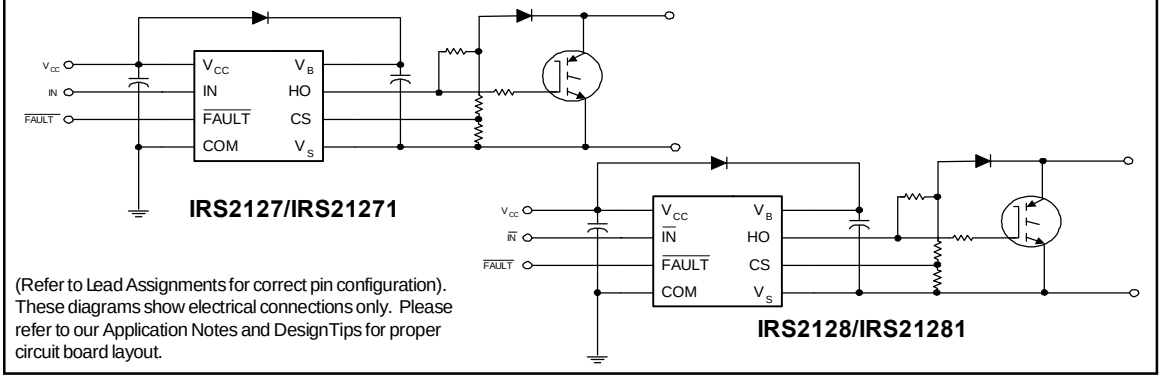
8-Lead PDIP

8-Lead SOIC

### Description

The IRS2127/IRS2128/IRS21271/IRS21281 are high voltage, high speed power MOSFET and IGBT drivers. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL outputs, down to 3.3 V. The protection circuity detects over-current in the driven power transistor and terminates the gate drive voltage. An open drain $\overline{\text{FAULT}}$ signal is provided to indicate that an over-current shutdown has occurred. The output driver features a high pulse current buffer stage designed for minimum cross-conduction. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high-side or low-side configuration which operates up to 600 V.

### Typical Connection




(Refer to Lead Assignments for correct pin configuration). These diagrams show electrical connections only. Please refer to our Application Notes and DesignTips for proper circuit board layout.

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



## Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

| Symbol | Definition | | Min. | Max. | Units |
|---|---|---|---|---|---|
| $V_B$ | High-side floating supply voltage | | -0.3 | 625 | V |
| $V_S$ | High-side floating offset voltage | | $V_B$ - 25 | $V_B$ + 0.3 | |
| $V_{HO}$ | High-side floating output voltage | | $V_S$ - 0.3 | $V_B$ + 0.3 | |
| $V_{CC}$ | Logic supply voltage | | -0.3 | 25 | |
| $V_{IN}$ | Logic input voltage | | -0.3 | $V_{CC}$ + 0.3 | |
| $V_{FLT}$ | $\overline{\text{FAULT}}$ output voltage | | -0.3 | $V_{CC}$ + 0.3 | |
| $V_{CS}$ | Current sense voltage | | $V_S$ - 0.3 | $V_B$ + 0.3 | |
| $dV_S/dt$ | Allowable offset supply voltage transient | | — | 50 | V/ns |
| $P_D$ | Package power dissipation @ $T_A \leq +25$ °C | 8-Lead DIP | — | 1.0 | W |
| | | 8-Lead SOIC | — | 0.625 | |
| $Rth_{JA}$ | Thermal resistance, junction to ambient | 8-Lead DIP | — | 125 | °C/W |
| | | 8-Lead SOIC | — | 200 | |
| $T_J$ | Junction temperature | | — | 150 | °C |
| $T_S$ | Storage temperature | | -55 | 150 | |
| $T_L$ | Lead temperature (soldering, 10 seconds) | | — | 300 | |

## Recommended Operating Conditions

The input/output logic timing diagram is shown in Fig. 1. For proper operation the device should be used within the recommended conditions. The $V_S$ offset rating is tested with all supplies biased at 15 V differential.

| Symbol | Definition | | Min. | Max. | Units |
|---|---|---|---|---|---|
| $V_B$ | High-side floating supply voltage | (IRS2127/IRS2128) | $V_S$ + 12 | $V_S$ + 20 | V |
| | | (IRS21271/IRS21281) | $V_S$ + 9 | $V_S$ + 20 | |
| $V_S$ | High-side floating offset voltage | | Note 1 | 600 | |
| $V_{HO}$ | High-side floating output voltage | | $V_S$ | $V_B$ | |
| $V_{CC}$ | Logic supply voltage | | 10 | 20 | |
| $V_{IN}$ | Logic input voltage | | 0 | $V_{CC}$ | |
| $V_{FLT}$ | $\overline{\text{FAULT}}$ output voltage | | 0 | $V_{CC}$ | |
| $V_{CS}$ | Current sense signal voltage | | $V_S$ | $V_S$ + 5 | |
| $T_A$ | Ambient temperature | | -40 | 125 | °C |

Note 1: Logic operational for $V_S$ of -5 V to +600 V. Logic state held for $V_S$ of -5 V to -$V_{BS}$. (Please refer to the Design Tip DT97-3 for more details).

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



## Dynamic Electrical Characteristics

$V_{BIAS}$ ($V_{CC}$, $V_{BS}$) = 15 V, $C_L$ = 1000 pF and $T_A$ = 25 °C unless otherwise specified. The dynamic electrical characteristics are measured using the test circuit shown in Fig. 3.

| Symbol | Definition | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $t_{on}$ | Turn-on propagation delay | — | 150 | 200 | ns | $V_S$ = 0 V |
| $t_{off}$ | Turn-off propagation delay | — | 150 | 200 | | $V_S$ = 600 V |
| $t_r$ | Turn-on rise time | — | 80 | 130 | | |
| $t_f$ | Turn-off fall time | — | 40 | 65 | | |
| $t_{bl}$ | Start-up blanking time | 550 | 750 | 950 | | |
| $t_{cs}$ | CS shutdown propagation delay | — | 65 | 360 | | |
| $t_{flt}$ | CS to $\overline{\text{FAULT}}$ pull-up propagation delay | — | 270 | 510 | | |

## Static Electrical Characteristics

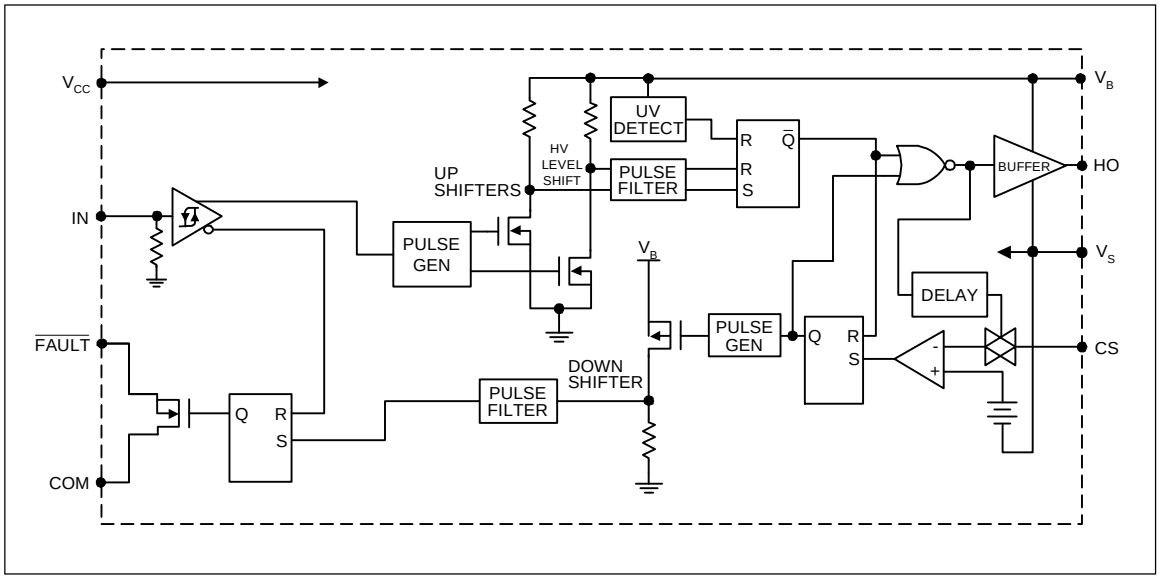
$V_{BIAS}$ ($V_{CC}$, $V_{BS}$) = 15 V and $T_A$ = 25 °C unless otherwise specified. The $V_{IN}$, $V_{TH}$, and $I_{IN}$ parameters are referenced to COM. The $V_O$ and $I_O$ parameters are referenced to $V_S$.

| Symbol | Definition | | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Logic “1” input voltage<br>Logic “0” input voltage | (IRS2127/IRS21271)<br>(IRS2128/IRS21281) | 2.5 | — | — | V | $V_{CC}$ = 10 V to 20 V |
| $V_{IL}$ | Logic “0” input voltage<br>Logic “1” input voltage | (IRS2127/IRS21271)<br>(IRS2128/IRS21281) | — | — | 0.8 | | |
| $V_{CSTH+}$ | CS input positive going threshold | (IRS2127/IRS2128) | 180 | 250 | 320 | mV | |
| | | (IRS21271/IRS21281) | 1.5 | 1.8 | 2.1 | V | |
| $V_{OH}$ | High level output voltage, $V_{BIAS}$ - $V_O$ | | — | 0.05 | 0.2 | V | $I_O$ = 2 mA |
| $V_{OL}$ | Low level output voltage, $V_O$ | | — | 0.02 | 0.1 | | |
| $I_{LK}$ | Offset supply leakage current | | — | — | 50 | µA | $V_B$ = $V_S$ = 600 V |
| $I_{QBS}$ | Quiescent $V_{BS}$ supply current | | — | 300 | 800 | | $V_{IN}$ = 0 V or 5 V |
| $I_{QCC}$ | Quiescent $V_{CC}$ supply current | | — | 60 | 120 | | |
| $I_{IN+}$ | Logic “1” input bias current | | — | 7.0 | 15 | | $V_{IN}$ = 5 V |
| $I_{IN-}$ | Logic “0” input bias current | | — | — | 5.0 | | $V_{IN}$ = 0 V |
| $I_{CS+}$ | “High” CS bias current | | — | — | 5.0 | | $V_{CS}$ = 3 V |
| $I_{CS-}$ | “High” CS bias current | | — | — | 5.0 | | $V_{CS}$ = 0 V |
| $V_{BSUV+}$ | $V_{BS}$ supply undervoltage positive going threshold | (IRS2127/IRS2128) | 8.8 | 10.3 | 11.8 | V | |
| | | (IRS21271/IRS21281) | 6.3 | 7.2 | 8.2 | | |
| $V_{BSUV-}$ | $V_{BS}$ supply undervoltage negative going threshold | (IRS2127/IRS2128) | 7.5 | 9.0 | 10.6 | | |
| | | (IRS21271/IRS21281) | 6.0 | 6.8 | 7.7 | | |
| $I_{O+}$ | Output high short circuit pulsed current | | 200 | 290 | — | mA | $V_O$ = 0 V, $V_{IN}$ = 5 V<br>PW ≤ 10 µs |
| $I_{O-}$ | Output low short circuit pulsed current | | 420 | 600 | — | | $V_O$ = 15 V, $V_{IN}$ = 0 V<br>PW ≤ 10 µs |
| $R_{On,FLT}$ | FAULT - low on resistance | | — | 125 | — | Ω | |

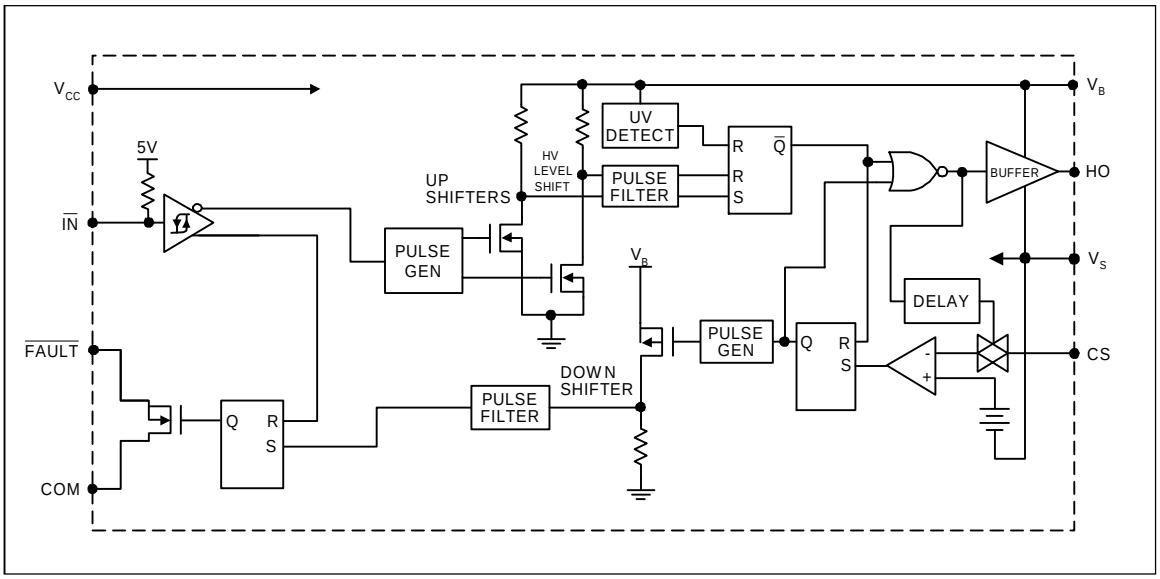
The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



## Functional Block Diagram IRS2127/IRS21271




## Functional Block Diagram IRS2128/IRS21281



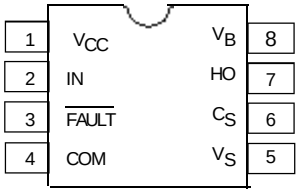
The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



## Lead Definitions

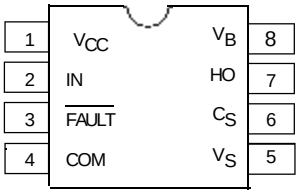
| Symbol | Description |
|---|---|
| $V_{CC}$ | Logic and gate drive supply |
| IN | Logic input for gate driver output (HO), in phase with HO (IRS2127/IRS21271) out of phase with HO (IRS2128/IRS21281) |
| $\overline{FAULT}$ | Indicates over-current shutdown has occurred, negative logic |
| COM | Logic ground |
| $V_B$ | High-side floating supply |
| HO | High-side gate drive output |
| $V_S$ | High-side floating supply return |
| CS | Current sense input to current sense comparator |

## Lead Assignments



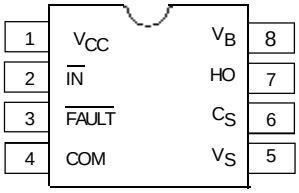

8 Lead PDIP

**IRS2127/IRS21271**



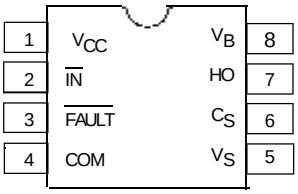

8 Lead SOIC

**IRS2127S/IRS21271S**




8 Lead PDIP

**IRS2128/IRS21281**




8 Lead SOIC

**IRS2128S/IRS21281S**

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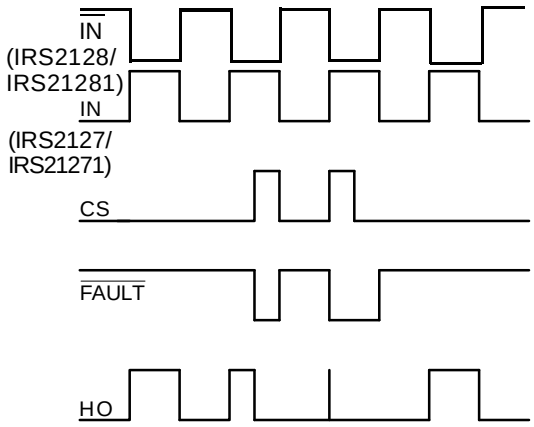


**Figure 1. Input/Output Timing Diagram**

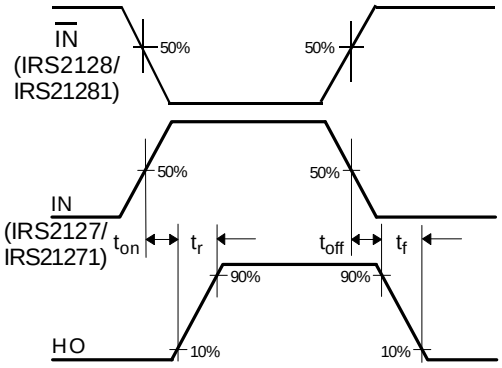


**Figure 2. Switching Time Waveform Definition**

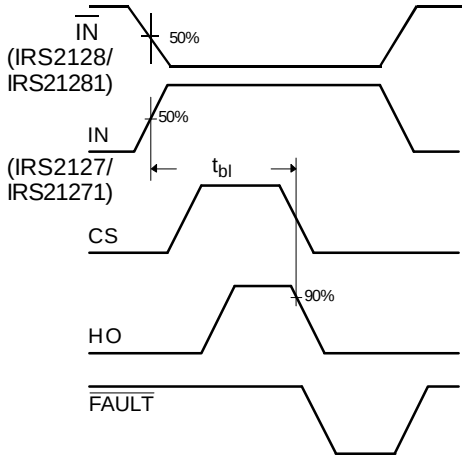


**Figure 3. Start-Up Blanking Time Waveform Definitions**

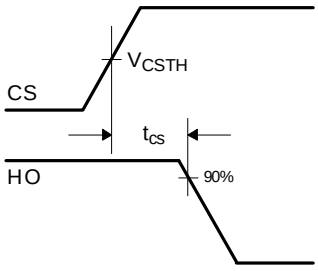


**Figure 4. CS Shutdown Waveform Definitions**

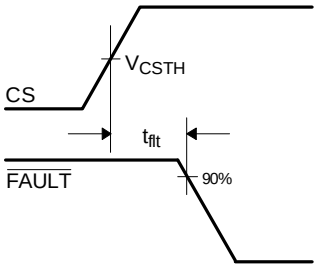


**Figure 5. CS to $\overline{\text{FAULT}}$ Waveform Definitions**

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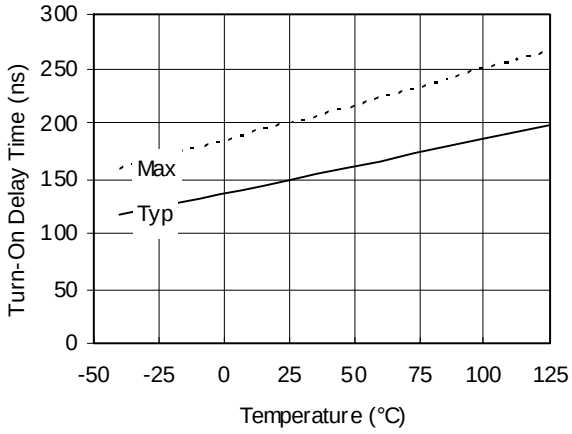


**Figure 6A. Turn-On Delay Time vs. Temperature**

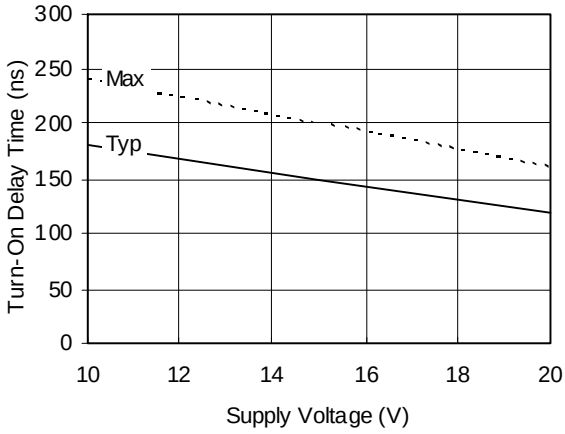


**Figure 6B. Turn-On Delay Time vs. Voltage**

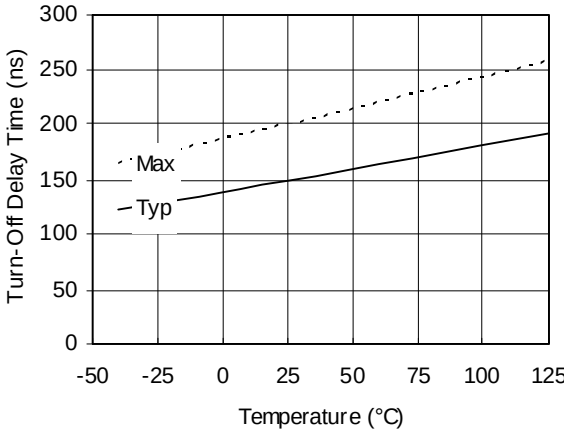


**Figure 7A. Turn-Off Delay Time vs. Temperature**

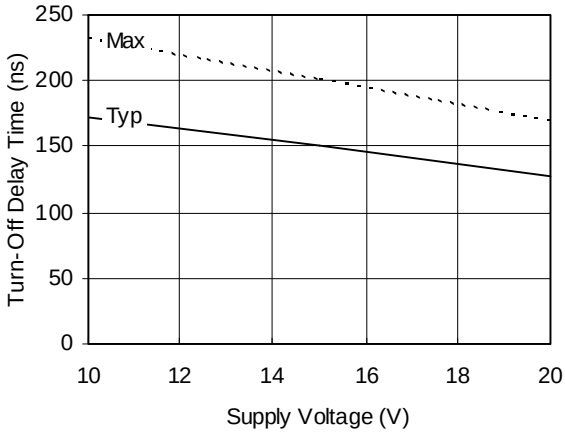


**Figure 7B. Turn-Off Delay Time vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



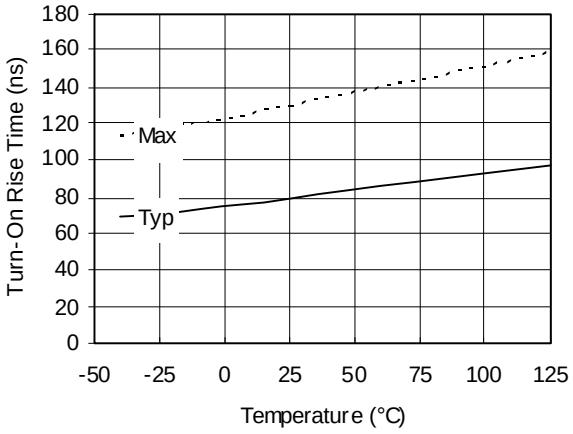


**Figure 8A. Turn-On Rise Time vs. Temperature**

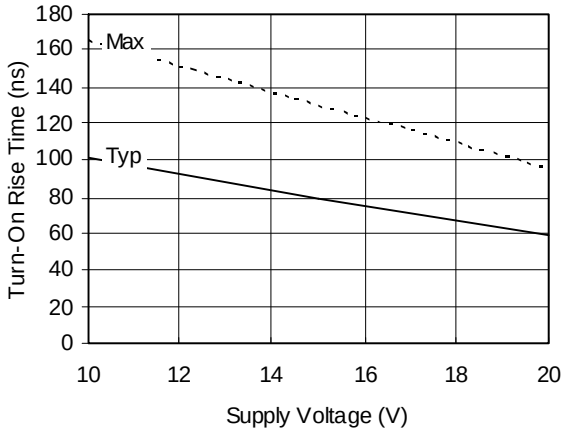


**Figure 8B. Turn-On Rise Time vs. Voltage**

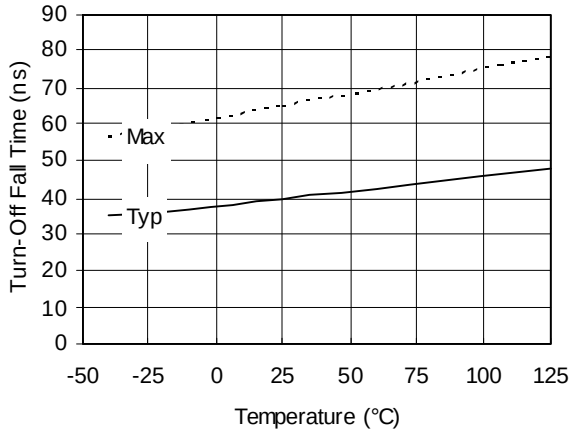


**Figure 9A. Turn-Off Fall Time vs. Temperature**

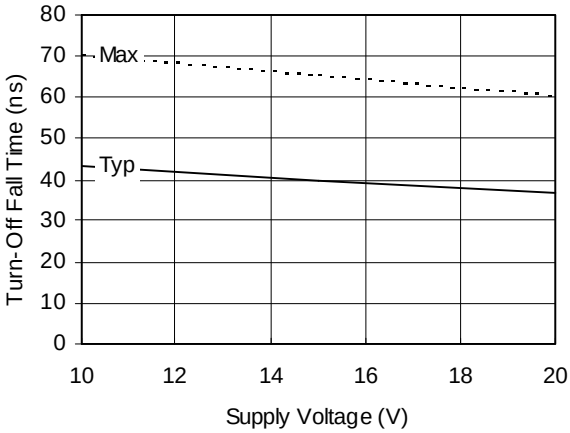


**Figure 9B. Turn-Off Fall Time vs. Voltage**

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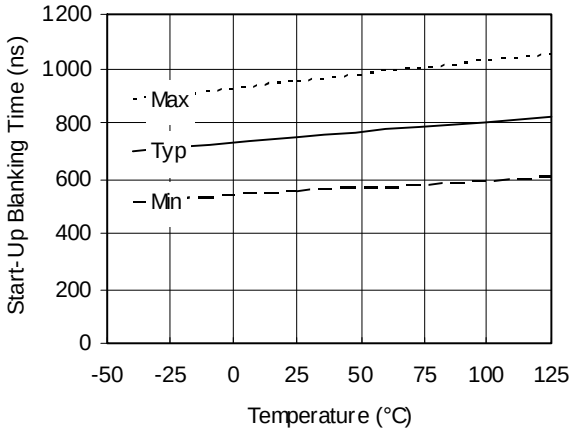


**Figure 10A. Start-Up Blanking Time vs. Temperature**

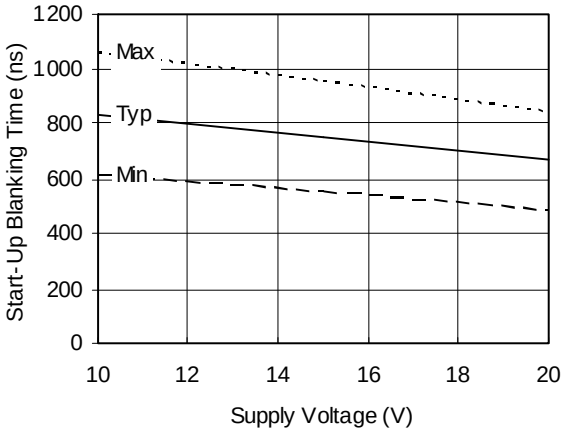


**Figure 10B. Start-Up Blanking Time vs. Voltage**

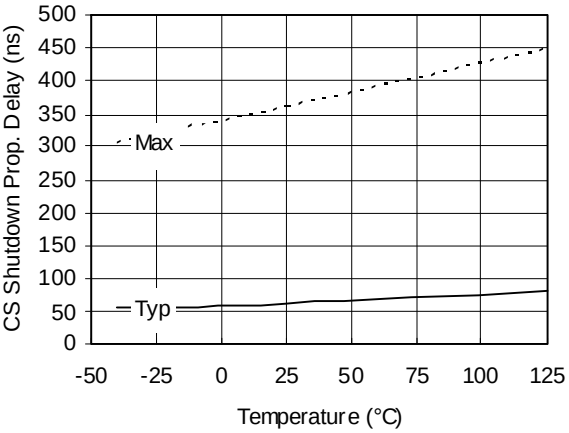


**Figure 11A. CS Shutdown Prop. Delay vs. Temperature**

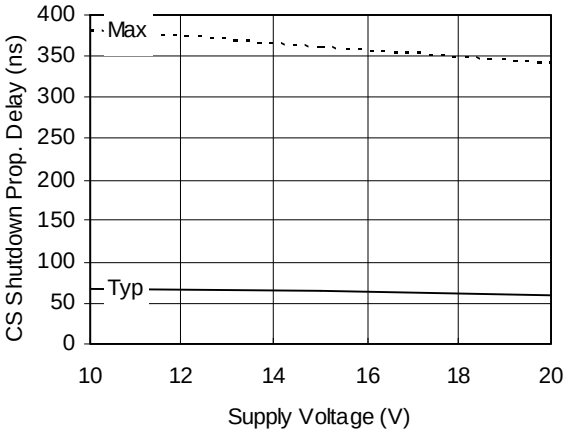


**Figure 11B. CS Shutdown Prop. Delay vs. Voltage**

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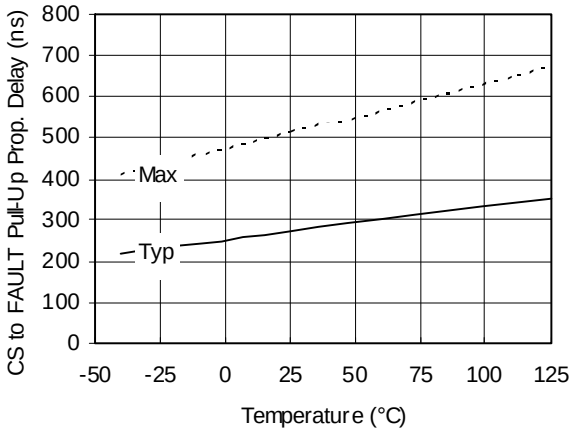



**Figure 12A. CS to FAULT Pull-Up Prop. Delay vs. Temperature**

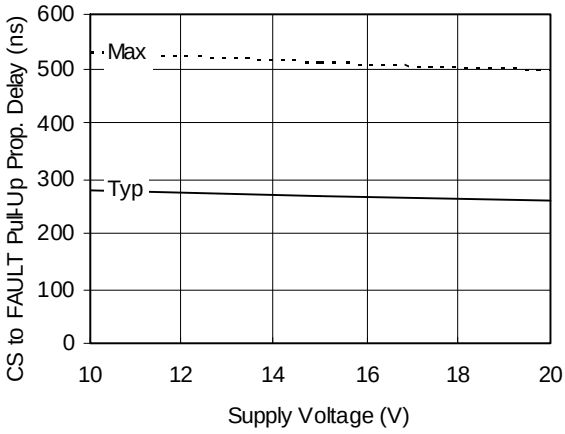



**Figure 12B. CS to FAULT Pull-Up Prop. Delay vs. Voltage**

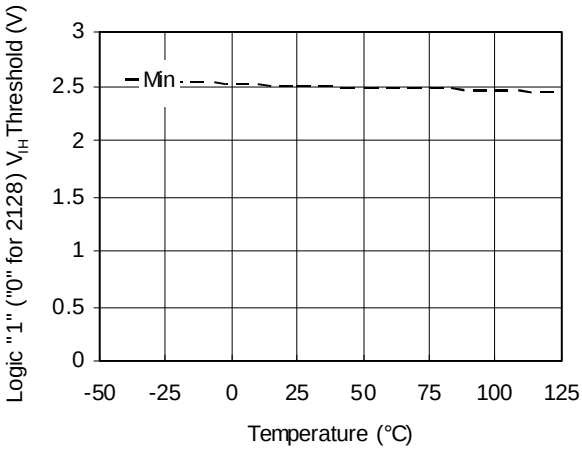



**Figure 13A. Logic "1" ("0" for 2128) $V_{IH}$ Threshold vs. Temperature**

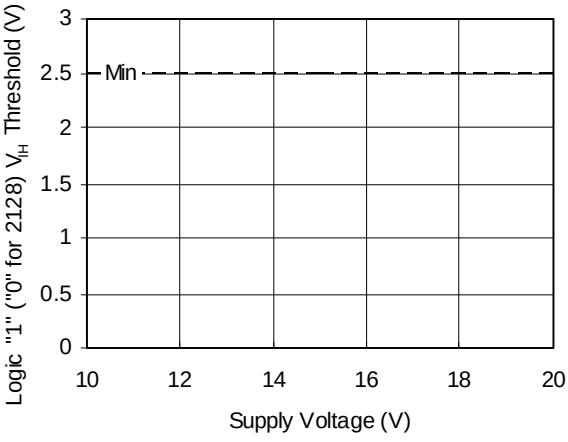



**Figure 13B. Logic "1" ("0" for 2128) $V_{IH}$ Threshold vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



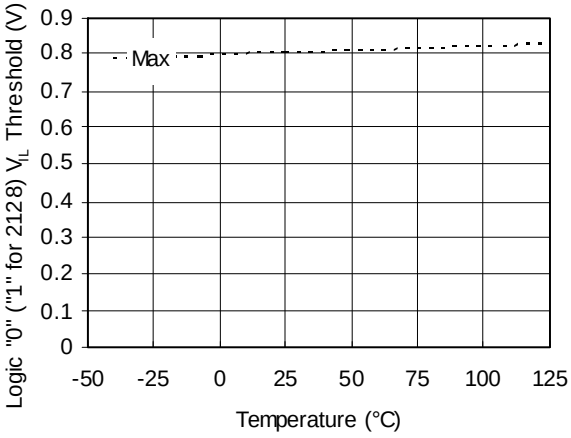



**Figure 14A. Logic "0" ("1" for 2128) $V_{IL}$ Threshold vs. Temperature**

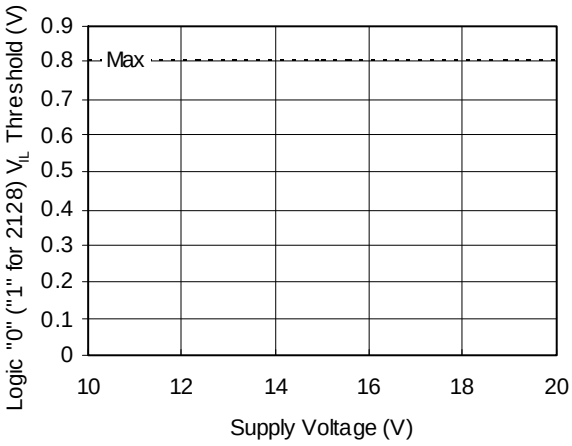



**Figure 14B. Logic "0" ("1" for 2128) $V_{IL}$ Threshold vs. Voltage**

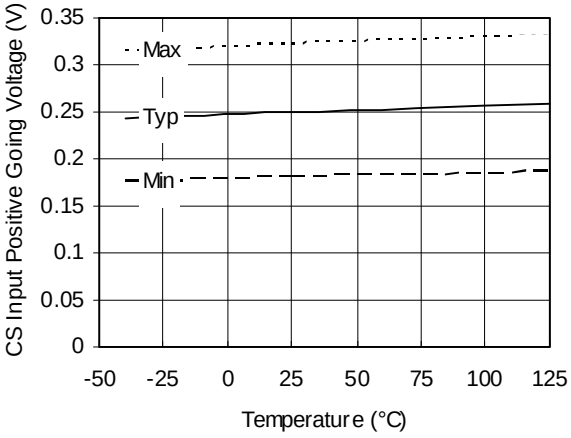



**Figure 15A. CS Input Positive Going Voltage vs. Temperature**

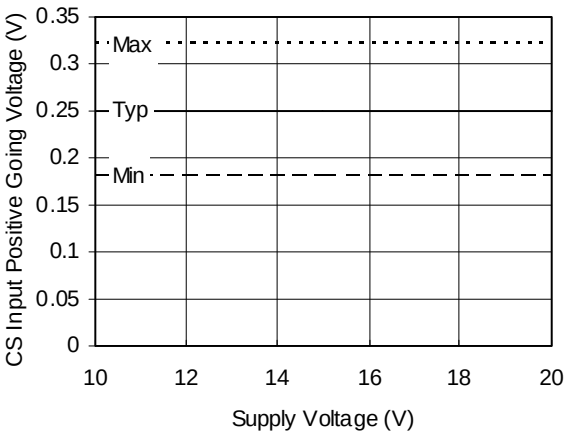



**Figure 15B. CS Input Positive Going Voltage vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



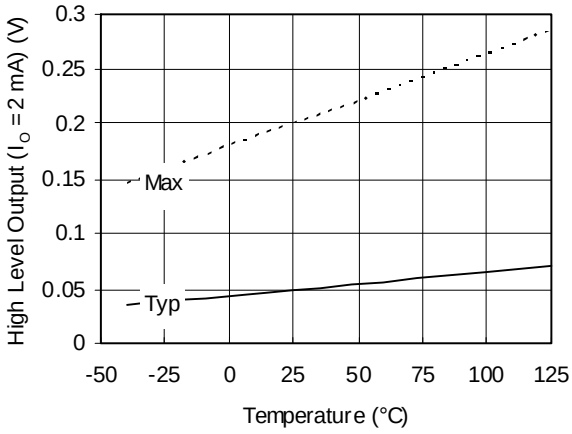



**Figure 16A. High Level Output ($I_O$ = 2 mA) vs. Temperature**

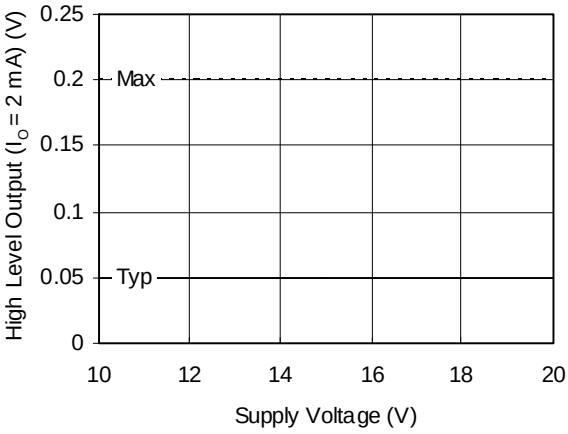



**Figure 16B. High Level Output ($I_O$ = 2 mA) vs. Voltage**

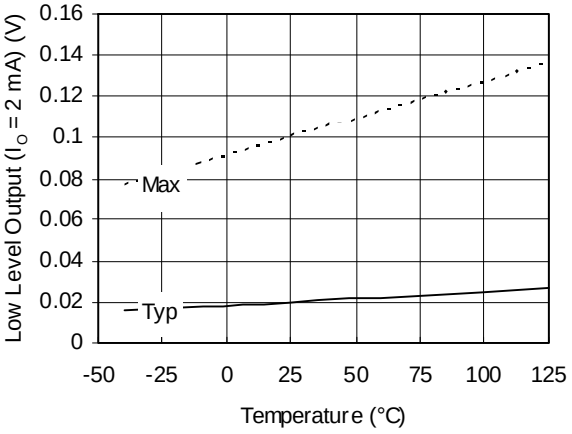



**Figure 17A. Low Level Output ($I_O$ = 2 mA) vs. Temperature**

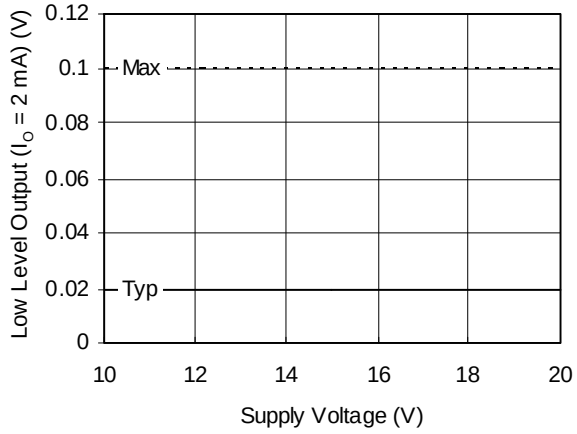



**Figure 17B. Low Level Output ($I_O$ = 2 mA) vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



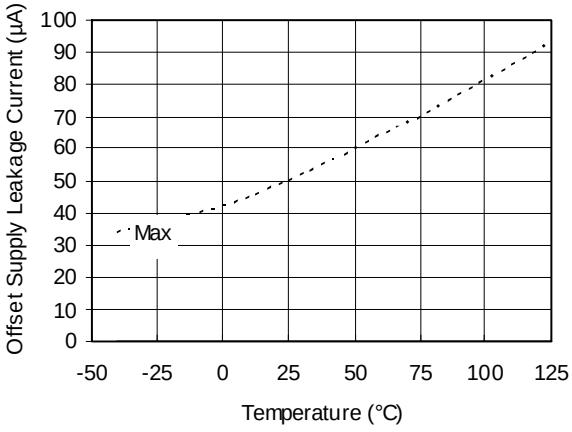



**Figure 18A. Offset Supply Leakage Current vs. Temperature**

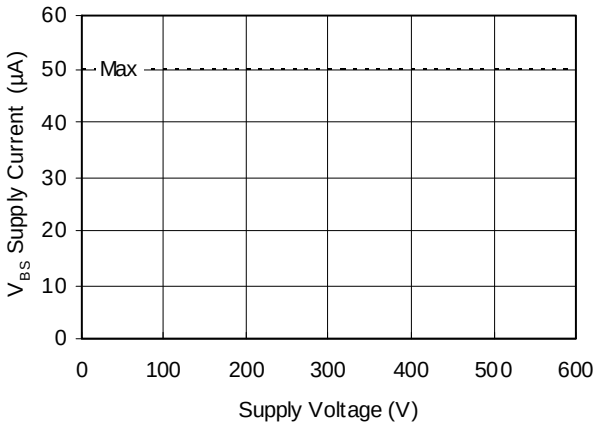



**Figure 18B. High-Side Floating Well Offset Supply Leakage vs. Voltage**

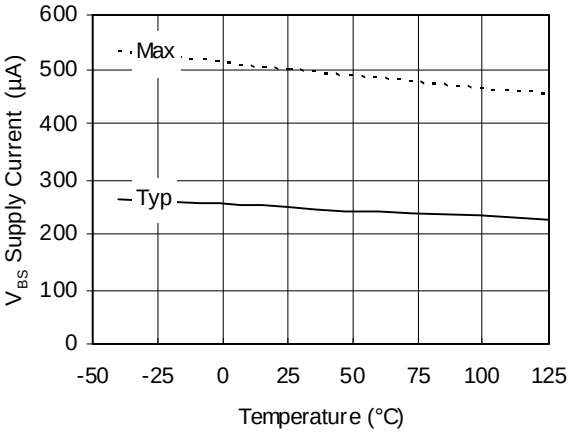



**Figure 19A. $V_{BS}$ Supply Current vs. Temperature**

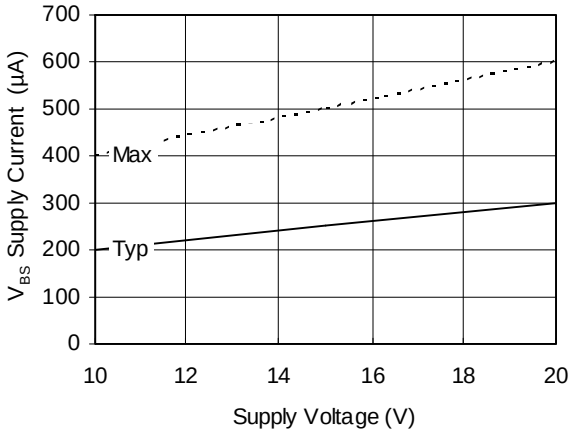



**Figure 19B. $V_{BS}$ Supply Current vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



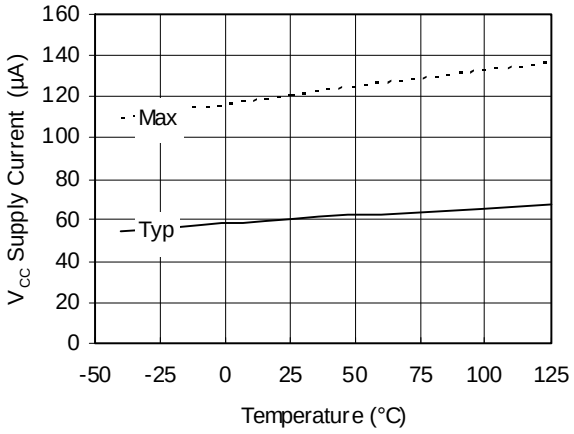



**Figure 20A. $V_{cc}$ Supply Current vs. Temperature**

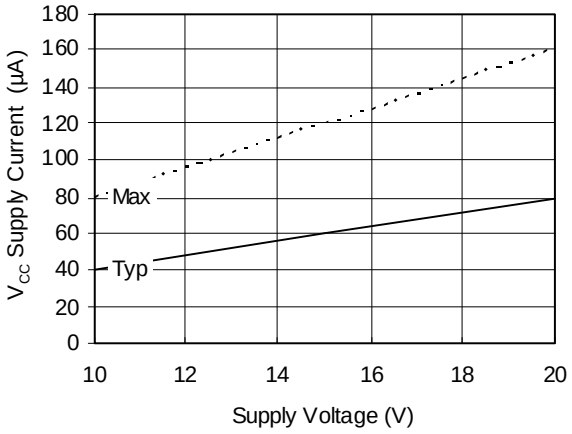



**Figure 20B. $V_{cc}$ Supply Current vs. Voltage**

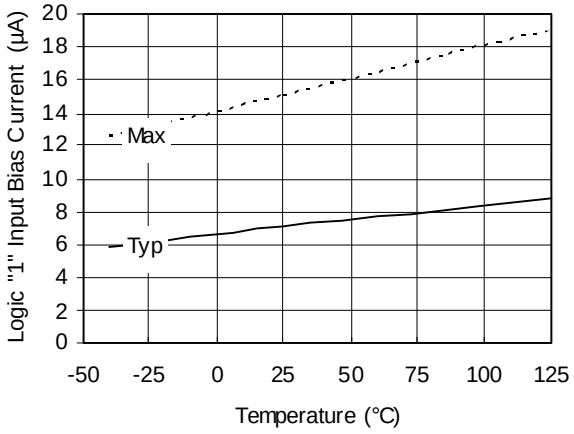



**Figure 21A. Logic "1" Input Bias Current vs. Temperature**

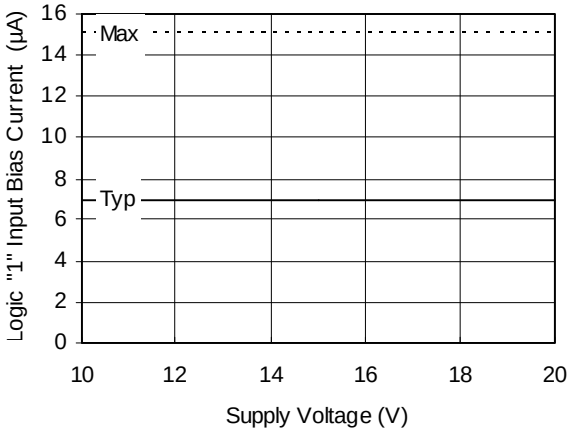



**Figure 21B. Logic "1" Input Bias Current vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



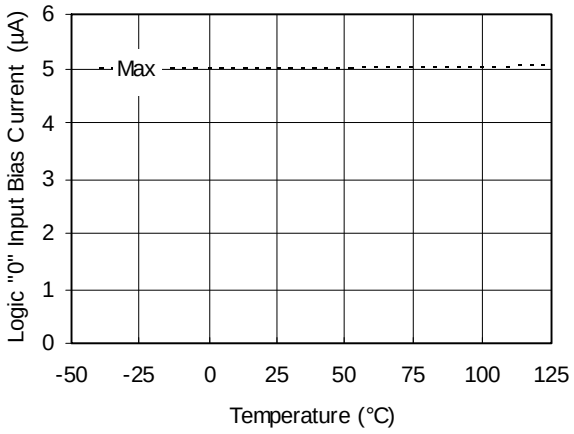



**Figure 22A. Logic "0" Input Bias Current vs. Temperature**

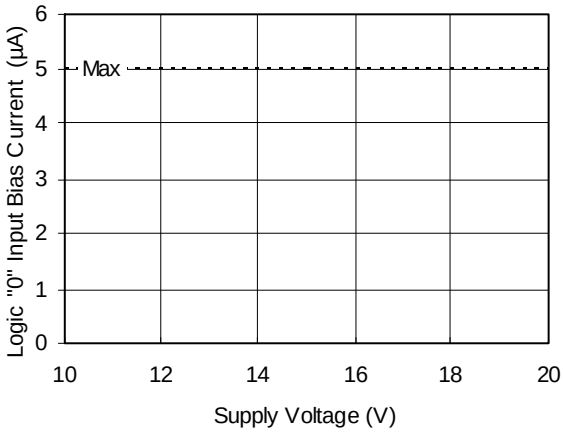



**Figure 22B. Logic "0" Input Bias Current vs. Voltage**

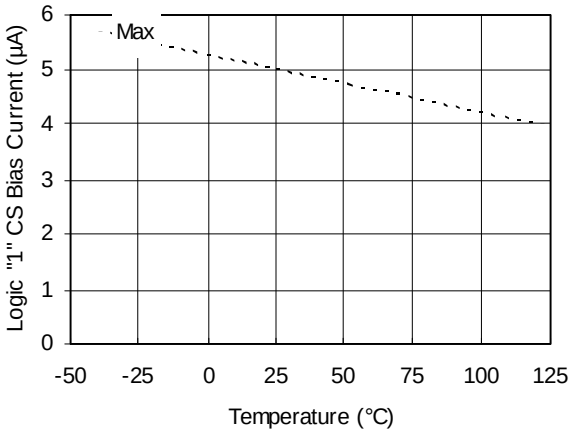



**Figure 23A. Logic "1" CS Bias Current vs. Temperature**

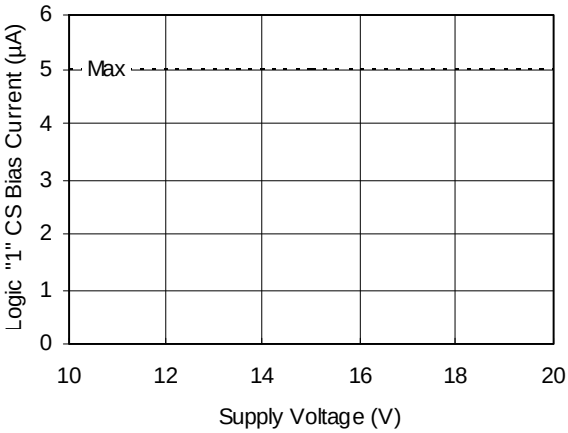



**Figure 23B. Logic "1" CS Bias Current vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



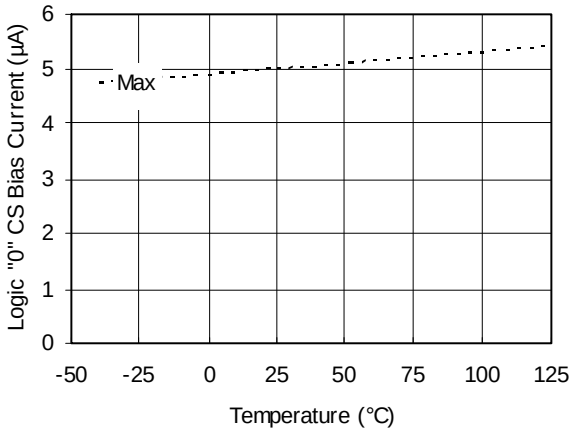



**Figure 24A. Logic "0" CS Bias Current vs. Temperature**

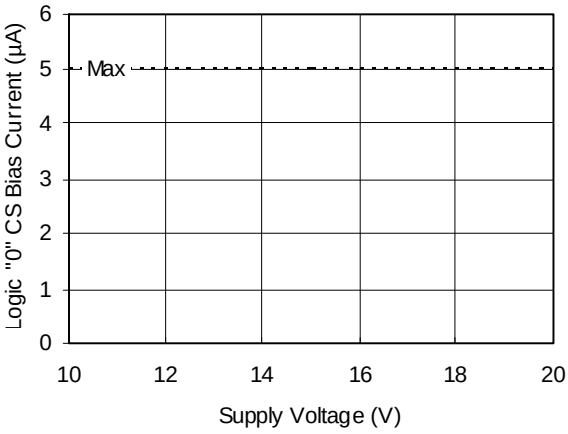



**Figure 24B. Logic "0" CS Bias Current vs. Voltage**

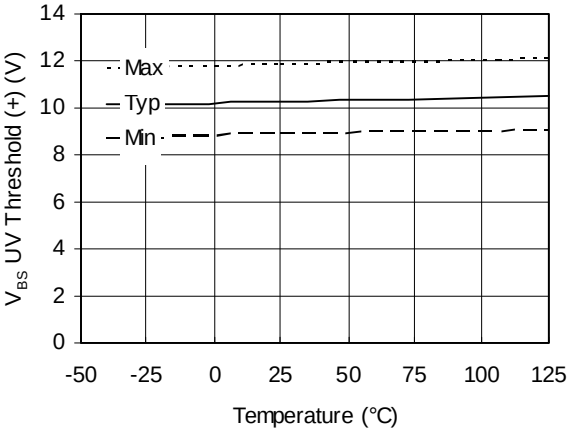



**Figure 25A. $V_{BS}$ UV Threshold (+) vs. Temperature**

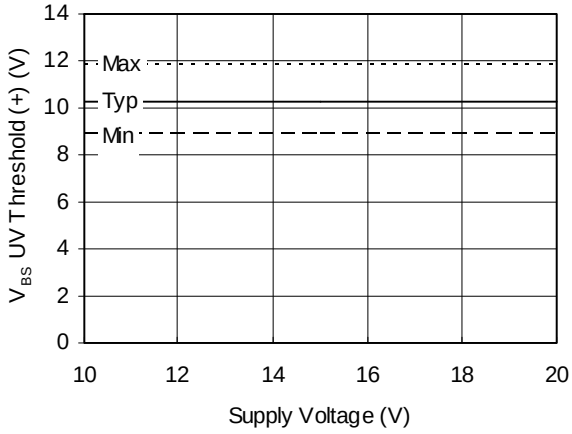



**Figure 25B. $V_{BS}$ UV Threshold (+) vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



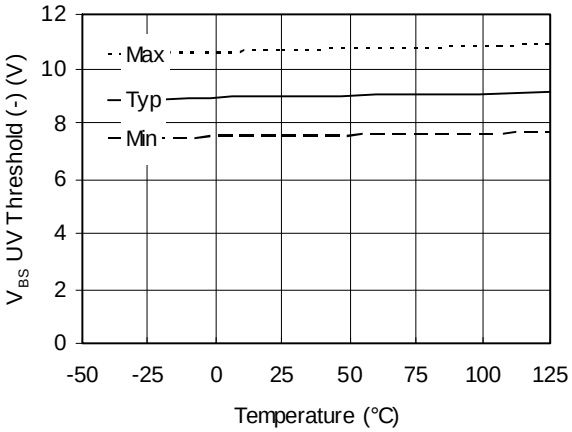



**Figure 26A. $V_{BS}$ UV Threshold (-) vs. Temperature**

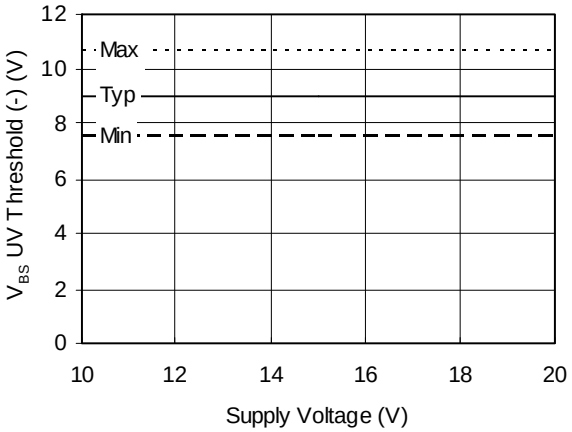



**Figure 26B. $V_{BS}$ UV Threshold (-) vs. Voltage**

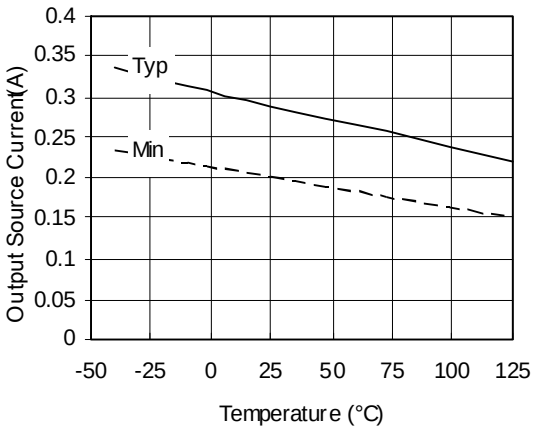



**Figure 27A. Output Source Current vs. Temperature**

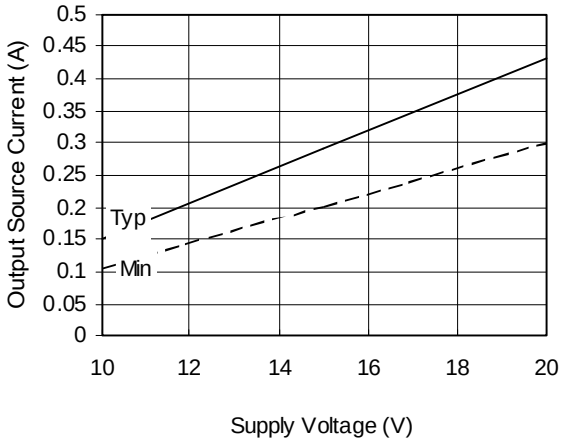



**Figure 27B. Output Source Current vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



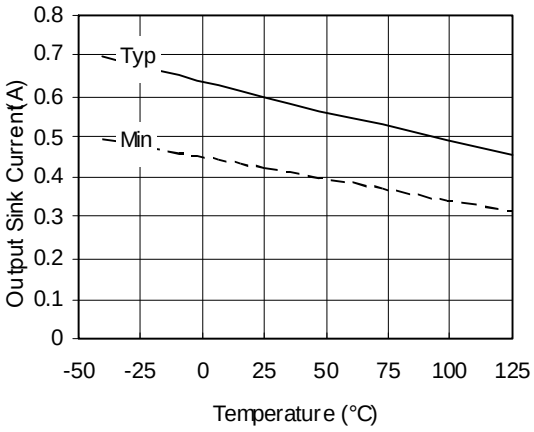



**Figure 28A. Output Sink Current vs. Temperature**

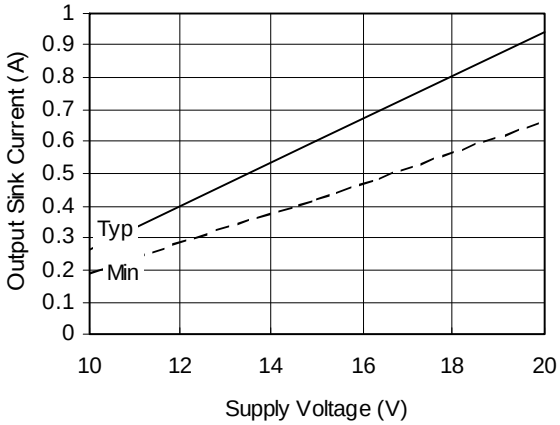
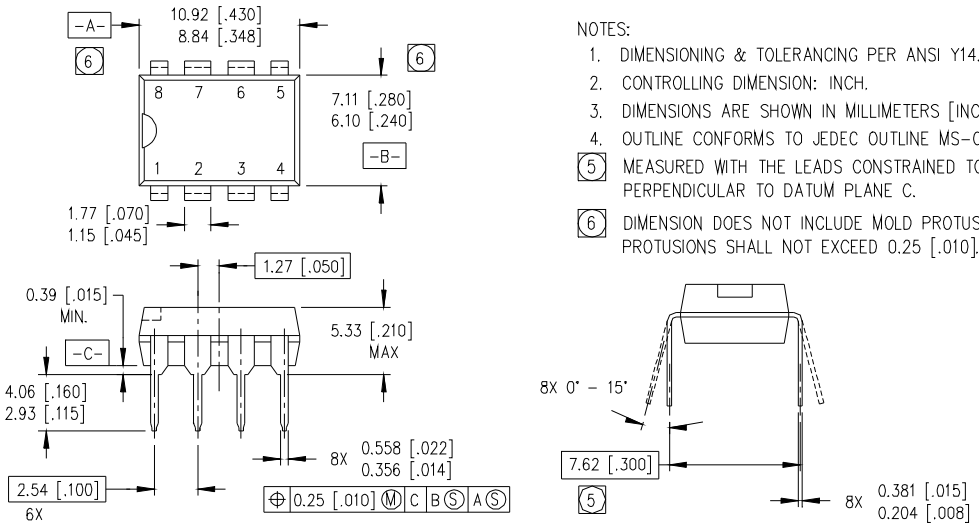



**Figure 28B. Output Sink Current vs. Voltage**

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF

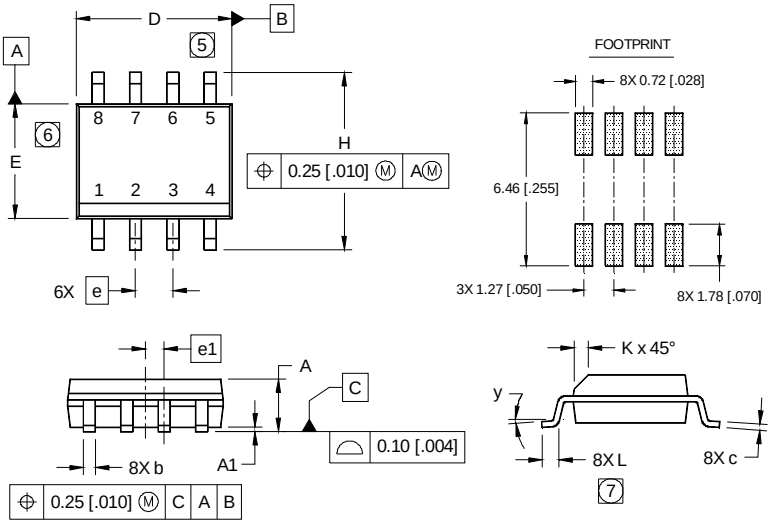


## Case outlines




**8-Lead PDIP**

01-6014
01-3003 01 (MS-001AB)




| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .0532 | .0688 | 1.35 | 1.75 |
| A1 | .0040 | .0098 | 0.10 | 0.25 |
| b | .013 | .020 | 0.33 | 0.51 |
| c | .0075 | .0098 | 0.19 | 0.25 |
| D | .189 | .1968 | 4.80 | 5.00 |
| E | .1497 | .1574 | 3.80 | 4.00 |
| e | .050 BASIC | | 1.27 BASIC | |
| e 1 | .025 BASIC | | 0.635 BASIC | |
| H | .2284 | .2440 | 5.80 | 6.20 |
| K | .0099 | .0196 | 0.25 | 0.50 |
| L | .016 | .050 | 0.40 | 1.27 |
| y | 0° | 8° | 0° | 8° |

NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.

5 DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [.006].
6 DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.010].
7 DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

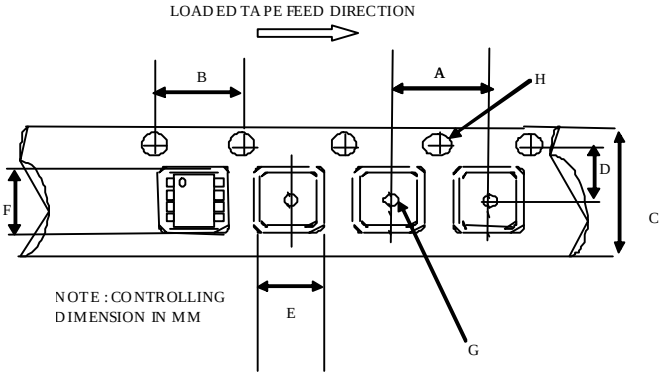
**8-Lead SOIC**

01-6027
01-0021 11 (MS-012AA)

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF

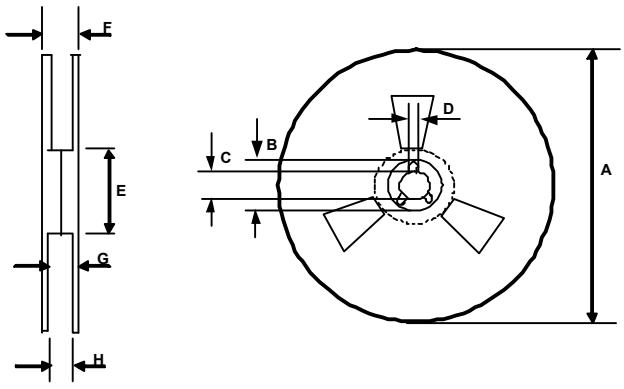


## Tape & Reel
## 8-lead SOIC




CARRIER TAPE DIMENSION FOR 8SOICN

| | Metric | | Imperial | |
|---|---|---|---|---|
| Code | Min | Max | Min | Max |
| A | 7.90 | 8.10 | 0.311 | 0.318 |
| B | 3.90 | 4.10 | 0.153 | 0.161 |
| C | 11.70 | 12.30 | 0.46 | 0.484 |
| D | 5.45 | 5.55 | 0.214 | 0.218 |
| E | 6.30 | 6.50 | 0.248 | 0.255 |
| F | 5.10 | 5.30 | 0.200 | 0.208 |
| G | 1.50 | n/a | 0.059 | n/a |
| H | 1.50 | 1.60 | 0.059 | 0.062 |



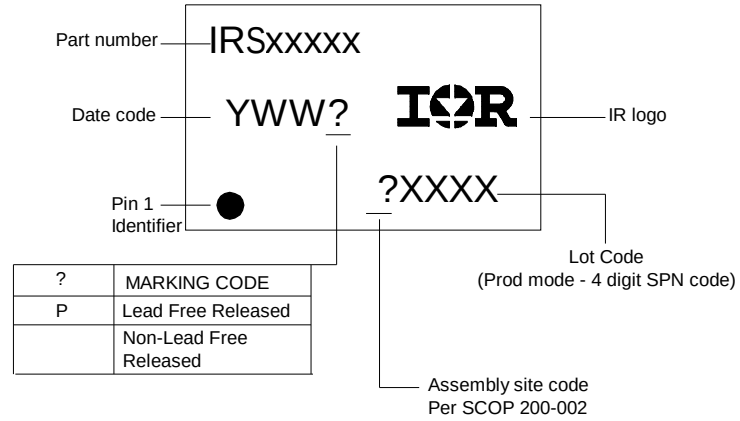

REEL DIMENSIONS FOR 8SOICN

| | Metric | | Imperial | |
|---|---|---|---|---|
| Code | Min | Max | Min | Max |
| A | 329.60 | 330.25 | 12.976 | 13.001 |
| B | 20.95 | 21.45 | 0.824 | 0.844 |
| C | 12.80 | 13.20 | 0.503 | 0.519 |
| D | 1.95 | 2.45 | 0.767 | 0.096 |
| E | 98.00 | 102.00 | 3.858 | 4.015 |
| F | n/a | 18.40 | n/a | 0.724 |
| G | 14.50 | 17.10 | 0.570 | 0.673 |
| H | 12.40 | 14.40 | 0.488 | 0.566 |

The IRS2128(S)PBF and IRS21281(S)PBF are not recommended for new designs. For new designs, we recommend IRS2127(S)PBF for IRS2128(S)PBF and IRS21271(S)PBF for IRS21281(S)PBF



## LEADFREE PART MARKING INFORMATION




| | |
|---|---|
| ? | MARKING CODE |
| P | Lead Free Released |
| | Non-Lead Free Released |

## ORDER INFORMATION

8-Lead PDIP IRS2127PbF
8-Lead PDIP IRS21271PbF
8-Lead SOIC IRS2127SPbF
8-Lead SOIC IRS21271SPbF
8-Lead SOIC Tape & Reel IRS2127STRPbF
8-Lead SOIC Tape & Reel IRS21271STRPbF

8-Lead PDIP IRS2128PbF
8-Lead PDIP IRS21281PbF
8-Lead SOIC IRS2128SPbF
8-Lead SOIC IRS21281SPbF
8-Lead SOIC Tape & Reel IRS2128STRPbF
8-Lead SOIC Tape & Reel IRS21281STRPbF



The SOIC-8 is MSL2 qualified.
This product has been designed and qualified for the industrial level.
Qualification standards can be found at www.irf.com

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245 Tel: (310) 252-7105

*Data and specifications subject to change without notice. 6/27/2007*

# OCEAN CHIPS
## Океан Электроники
## Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

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