ISL2110, ISL2111

100V, 3A/4A Peak, High Frequency Half-Bridge Drivers

FN6295
Rev.7.00
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The ISL2110, ISL2111 are 100V, high frequency, half-bridge N-Channel power MOSFET driver ICs. They are based on the popular HIP2100, HIP2101 half-bridge drivers, but offer several performance improvements. Peak output pull-up/pull-down current has been increased to 3A/4A, which significantly reduces switching power losses and eliminates the need for external totem-pole buffers in many applications. Also, the low end of the V_{DD} operational supply range has been extended to 8VDC. The ISL2110 has additional input hysteresis for superior operation in noisy environments and the inputs of the ISL2111, like those of the ISL2110, can now safely swing to the V_{DD} supply rail.

Related Literature

- For a full list of related documents, visit our website
  - ISL2110, ISL2111 product pages

Applications

- Telecom half-bridge DC/DC converters
- Telecom full-bridge DC/DC converters
- Two-switch forward converters
- Active-clamp forward converters
- Class-D audio amplifiers

Features

- Drives N-Channel MOSFET half-bridge
- SOIC, DFN, and TDFN package options
- SOIC, DFN, and TDFN packages compliant with 100V conductor spacing guidelines per IPC-2221
- Pb-free (RoHS compliant)
- Bootstrap supply max voltage to 114VDC
- On-chip 1W bootstrap diode
- Fast propagation times for multi-MHz circuits
- Drives 1nF load with typical rise/fall times of 9ns/7.5ns
- CMOS compatible input thresholds (ISL2110)
- 3.3V/TTL compatible input thresholds (ISL2111)
- Independent inputs provide flexibility
- No start-up problems
- Outputs unaffected by supply glitches, HS ringing below ground or HS slewing at high dv/dt
- Low power consumption
- Wide supply voltage range (8V to 14V)
- Supply undervoltage protection
- 1.6W/1W typical output pull-up/pull-down resistance

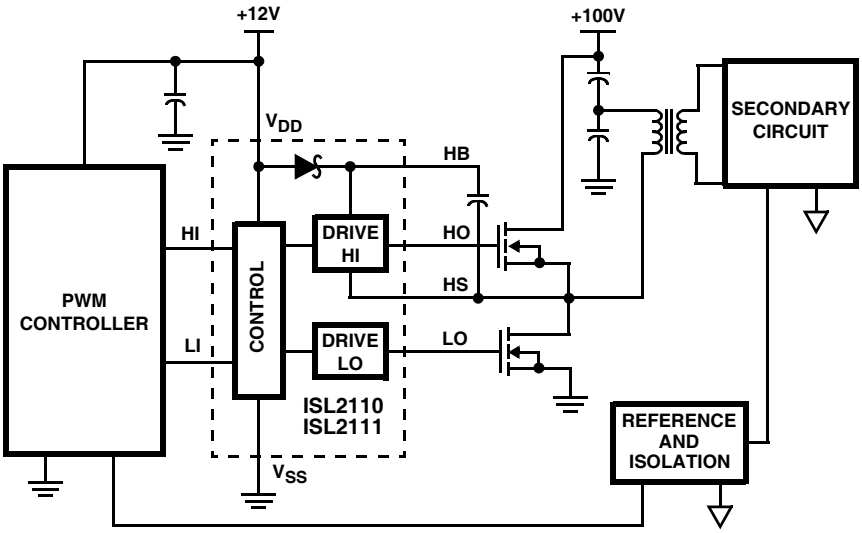
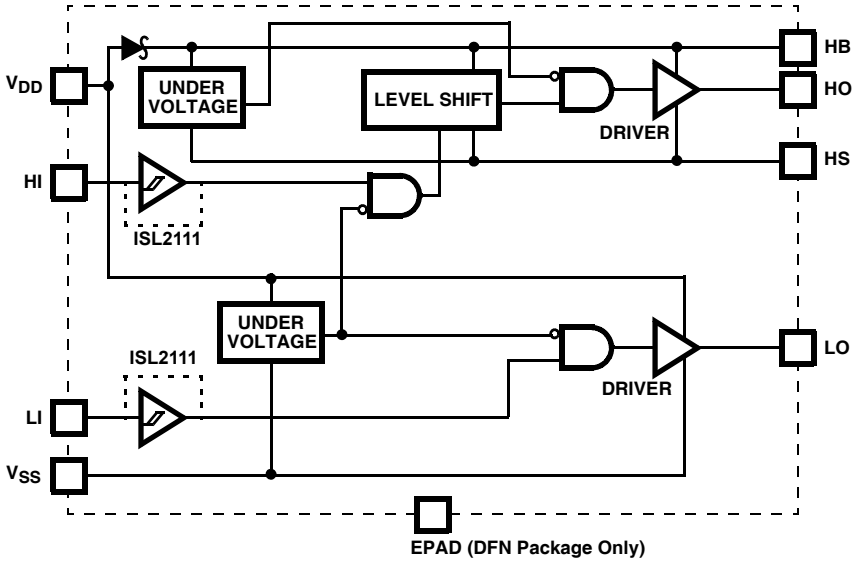


FIGURE 1. APPLICATION BLOCK DIAGRAM

Functional Block Diagram



*EPAD = Exposed Pad. The EPAD is electrically isolated from all other pins. For best thermal performance, connect the EPAD to the PCB power ground plane.

FIGURE 2. FUNCTIONAL BLOCK DIAGRAM

Application Diagrams

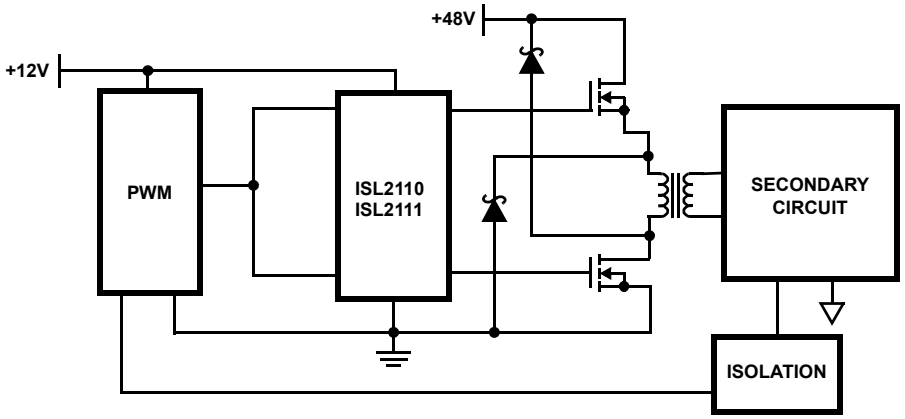


FIGURE 3. TWO-SWITCH FORWARD CONVERTER

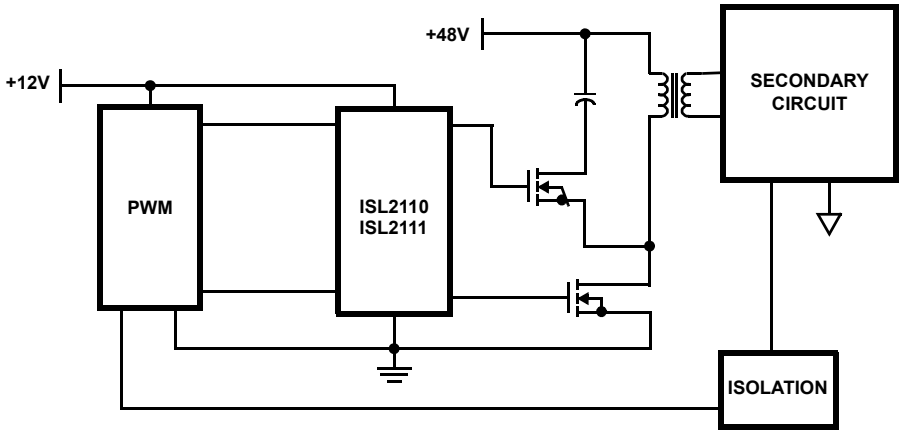


FIGURE 4. FORWARD CONVERTER WITH AN ACTIVE-CLAMP

Ordering Information

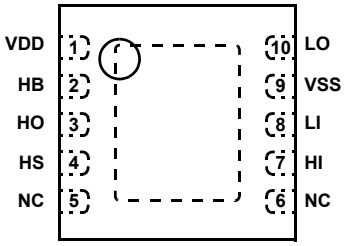
PART NUMBER (Notes 3, 4)	PART MARKING	TEMP RANGE (°C)	PACKAGE (RoHS COMPLIANT)	PKG. DWG. #
ISL2110ABZ (Note 1)	2110 ABZ	-40 to +125	8 Ld SOIC	M8.15
ISL2110AR4Z (Note 2)	211 0AR4Z	-40 to +125	12 Ld 4x4 DFN	L12.4x4A
ISL2111ABZ (Note 1)	2111 ABZ	-40 to +125	8 Ld SOIC	M8.15
ISL2111AR4Z (Note 2)	211 1AR4Z	-40 to +125	12 Ld 4x4 DFN	L12.4x4A
ISL2111ARTZ (Note 2)	211 1ARTZ	-40 to +125	10 Ld 4x4 TDFN	L10.4x4
ISL2111BR4Z (Note 2)	211 1BR4Z	-40 to +125	8 Ld 4x4 DFN	L8.4x4

NOTES:

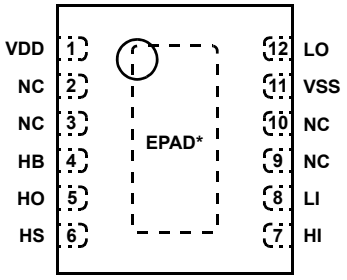
1. Add "-T" for 2.5k unit tape and reel options. Refer to TB347 for details on reel specifications.
2. Add "-T" suffix for 6k unit tape and reel options. Refer to TB347 for details on reel specifications.
3. These Intersil Pb-free plastic packaged products employ special Pb-free material sets, molding compounds/die attach materials, and 100% matte tin plate plus anneal (e3 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations). Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.
4. For Moisture Sensitivity Level (MSL), please see device information page for ISL2110, ISL2111. For more information on MSL, see Tech Brief TB363.

Pin Configurations

ISL2111ARTZ
(10 LD 4x4 TDFN)
TOP VIEW

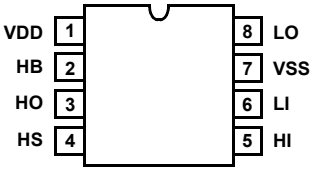


ISL2110AR4Z, ISL2111AR4Z
(12 LD 4x4 DFN)
TOP VIEW

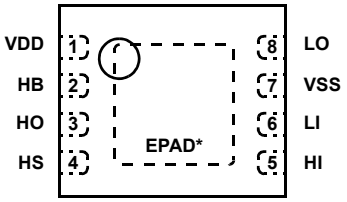


*EPAD = EXPOSED PAD

ISL2110ABZ, ISL2111ABZ
(8 LD SOIC)
TOP VIEW



ISL2111BR4Z
(8 LD 4x4 DFN)
TOP VIEW



*EPAD = EXPOSED PAD

Pin Descriptions

SYMBOL	DESCRIPTION
VDD	Positive supply to lower gate driver. Bypass this pin to VSS.
HB	High-side bootstrap supply. External bootstrap capacitor is required. Connect positive side of bootstrap capacitor to this pin. Bootstrap diode is on-chip.
HO	High-side output. Connect to gate of high-side power MOSFET.
HS	High-side source connection. Connect to source of high-side power MOSFET. Connect negative side of bootstrap capacitor to this pin.
HI	High-side input
LI	Low-side input
VSS	Chip negative supply, which will generally be ground.
LO	Low-side output. Connect to gate of low-side power MOSFET.
NC	No connect
EPAD	Exposed pad. Connect to ground or float. The EPAD is electrically isolated from all other pins.

Absolute Maximum Ratings

Supply Voltage, V_{DD}, V_{HB} - V_{HS} (Notes 5, 6) . . . . . 0.3V to 18V
LI and HI Voltages (Note 6) . . . . . -0.3V to V_{DD} + 0.3V
Voltage on LO (Note 6) . . . . . -0.3V to V_{DD} + 0.3V
Voltage on HO (Note 6) . . . . . V_{HS} - 0.3V to V_{HB} + 0.3V
Voltage on HS (Continuous) (Note 6) . . . . . -1V to 110V
Voltage on HB (Note 6) 118V
Average Current in V_{DD} to HB Diode 100mA

Maximum Recommended Operating Conditions

Supply Voltage, V_{DD} . . . . . 8V to 14V
Voltage on HS . . . . . -1V to 100V
Voltage on HS . . . . . (Repetitive Transient) -5V to 105V
Voltage on HB . . . . . V_{HS} + 7V to V_{HS} + 14V and V_{DD} - 1V to V_{DD} + 100V
HS Slew Rate . . . . . <50V/ns

Thermal Information

Thermal Resistance (Typical)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
8 Ld SOIC (Notes 7, 10)	95	46
10 Ld TDFN (Notes 8, 9)	40	2.5
12 Ld DFN (Notes 8, 9)	39	2.5
8 Ld DFN (Notes 8, 9)	40	4.0

Max Power Dissipation at +25°C in Free Air
8 Ld SOIC (Notes 7, 10) 1.3W
10 Ld TDFN (Notes 8, 9) 3.0W
12 Ld DFN (Notes 8, 9) 3.1W
8 Ld DFN (Notes 8, 9) 3.1W
Storage Temperature Range . . . . . -65°C to +150°C
Junction Temperature Range . . . . . -55°C to +150°C
Pb-Free Reflow Profile . . . . . see TB493

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions may adversely impact product reliability and result in failures not covered by warranty.

NOTES:

5. The ISL2110 and ISL2111 are capable of derated operation at supply voltages exceeding 14V. Figure 24 shows the high-side voltage derating curve for this mode of operation.
6. All voltages referenced to V_{SS} unless otherwise specified.
7. θ_{JA} is measured with the component mounted on a high-effective thermal conductivity test board in free air. See Tech Brief TB379 for details.
8. θ_{JA} is measured in free air with the component mounted on a high-effective thermal conductivity test board with “direct attach” features. See Tech Brief TB379.
9. For θ_{JC}, the “case temp” location is the center of the exposed metal pad on the package underside.
10. For θ_{JC}, the “case temp” location is taken at the package top center.

Electrical Specifications

V_{DD} = V_{HB} = 12V, V_{SS} = V_{HS} = 0V, no load on LO or HO, unless otherwise specified.

PARAMETERS	SYMBOL	TEST CONDITIONS	T_J = +25°C			T_J = -40°C to +125°C		UNIT
			MIN (Note 11)	TYP	MAX (Note 11)	MIN (Note 11)	MAX (Note 11)	
SUPPLY CURRENTS								
V_{DD} Quiescent Current	I_{DD}	ISL2110; LI = HI = 0V	-	0.10	0.25	-	0.30	mA
V_{DD} Quiescent Current	I_{DD}	ISL2111; LI = HI = 0V	-	0.30	0.45	-	0.55	mA
V_{DD} Operating Current	I_{DDO}	ISL2110; f = 500kHz	-	3.4	5.0	-	5.5	mA
V_{DD} Operating Current	I_{DDO}	ISL2111; f = 500kHz	-	3.5	5.0	-	5.5	mA
Total HB Quiescent Current	I_{HB}	LI = HI = 0V	-	0.10	0.15	-	0.20	mA
Total HB Operating Current	I_{HBO}	f = 500kHz	-	3.4	5.0	-	5.5	mA
HB to V_{SS} Current, Quiescent	I_{HBS}	LI = HI = 0V; V_{HB} = V_{HS} = 114V	-	0.05	1.50	-	10	µA
HB to V_{SS} Current, Operating	I_{HBSO}	f = 500kHz; V_{HB} = V_{HS} = 114V	-	1.2	-	-	-	mA
INPUT PINS								
Low Level Input Voltage Threshold	V_{IL}	ISL2110	3.7	4.4	-	3.5	-	V
Low Level Input Voltage Threshold	V_{IL}	ISL2111	1.4	1.8	-	1.2	-	V
High Level Input Voltage Threshold	V_{IH}	ISL2110	-	6.6	7.4	-	7.6	V
High Level Input Voltage Threshold	V_{IH}	ISL2111	-	1.8	2.2	-	2.4	V
Input Voltage Hysteresis	V_{IHYS}	ISL2110	-	2.2	-	-	-	V
Input Pull-Down Resistance	R_I		-	210	-	100	500	kΩ

Electrical Specifications

$V_{DD} = V_{HB} = 12V$, $V_{SS} = V_{HS} = 0V$, no load on LO or HO, unless otherwise specified. **(Continued)**

PARAMETERS	SYMBOL	TEST CONDITIONS	$T_J = +25°C$			$T_J = -40°C$ to $+125°C$		UNIT
			MIN (Note 11)	TYP	MAX (Note 11)	MIN (Note 11)	MAX (Note 11)	
UNDERVOLTAGE PROTECTION								
V_{DD} Rising Threshold	V_{DDR}		6.1	6.6	7.1	5.8	7.4	V
V_{DD} Threshold Hysteresis	V_{DDH}		-	0.6	-	-	-	V
HB Rising Threshold	V_{HBR}		5.5	6.1	6.8	5.0	7.1	V
HB Threshold Hysteresis	V_{HBH}		-	0.6	-	-	-	V
BOOTSTRAP DIODE								
Low Current Forward Voltage	V_{DL}	$I_{VDD-HB} = 100\mu A$	-	0.5	0.6	-	0.7	V
High Current Forward Voltage	V_{DH}	$I_{VDD-HB} = 100mA$	-	0.7	0.9	-	1	V
Dynamic Resistance	R_D	$I_{VDD-HB} = 100mA$	-	0.7	1	-	1.5	Ω
LO GATE DRIVER								
Low Level Output Voltage	V_{OLL}	$I_{LO} = 100mA$	-	0.1	0.18	-	0.25	V
High Level Output Voltage	V_{OHL}	$I_{LO} = -100mA$, $V_{OHL} = V_{DD} - V_{LO}$	-	0.16	0.23	-	0.3	V
Peak Pull-Up Current	I_{OHL}	$V_{LO} = 0V$	-	3	-	-	-	A
Peak Pull-Down Current	I_{OLL}	$V_{LO} = 12V$	-	4	-	-	-	A
HO GATE DRIVER								
Low Level Output Voltage	V_{OLH}	$I_{HO} = 100mA$	-	0.1	0.18	-	0.25	V
High Level Output Voltage	V_{OHH}	$I_{HO} = -100mA$, $V_{OHH} = V_{HB} - V_{HO}$	-	0.16	0.23	-	0.3	V
Peak Pull-Up Current	I_{OHH}	$V_{HO} = 0V$	-	3	-	-	-	A
Peak Pull-Down Current	I_{OLH}	$V_{HO} = 12V$	-	4	-	-	-	A

Switching Specifications

$V_{DD} = V_{HB} = 12V$, $V_{SS} = V_{HS} = 0V$, No Load on LO or HO, unless otherwise specified.

PARAMETERS	SYMBOL	TEST CONDITIONS	$T_J = +25°C$			$T_J = -40°C$ to $+125°C$		UNIT
			MIN (Note 11)	TYP	MAX (Note 11)	MIN (Note 11)	MAX (Note 11)	
Lower Turn-Off Propagation Delay (LI Falling to LO Falling)	t_{LPHL}		-	32	50	-	60	ns
Upper Turn-Off Propagation Delay (HI Falling to HO Falling)	t_{HPHL}		-	32	50	-	60	ns
Lower Turn-On Propagation Delay (LI Rising to LO Rising)	t_{LPLH}		-	39	50	-	60	ns
Upper Turn-On Propagation Delay (HI Rising to HO Rising)	t_{HPLH}		-	38	50	-	60	ns
Delay Matching: Upper Turn-Off to Lower Turn-On	t_{MON}		1	8	-	-	16	ns
Delay Matching: Lower Turn-Off to Upper Turn-On	t_{MOFF}		1	6	-	-	16	ns
Either Output Rise Time (10% to 90%)	t_{RC}	$C_L = 1nF$	-	9	-	-	-	ns
Either Output Fall Time (90% to 10%)	t_{FC}	$C_L = 1nF$	-	7.5	-	-	-	ns
Either Output Rise Time (3V to 9V)	t_R	$C_L = 0.1\mu F$	-	0.3	0.4	-	0.5	µs
Either Output Fall Time (9V to 3V)	t_F	$C_L = 0.1\mu F$	-	0.19	0.3	-	0.4	µs
Minimum Input Pulse Width that Changes the Output	t_{PW}		-	-	-	-	50	ns
Bootstrap Diode Turn-On or Turn-Off Time	t_{BS}		-	10	-	-	-	ns

NOTE:

11. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified. Temperature limits established by characterization and are not production tested.

Timing Diagrams

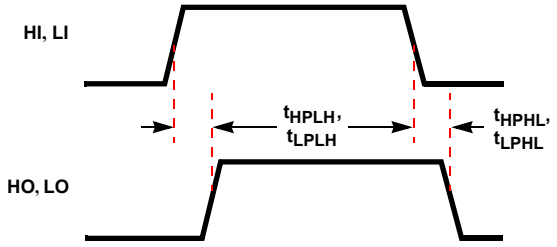


FIGURE 5. PROPAGATION DELAYS

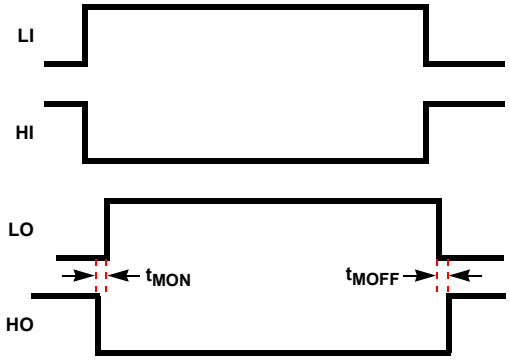


FIGURE 6. DELAY MATCHING

Typical Performance Curves

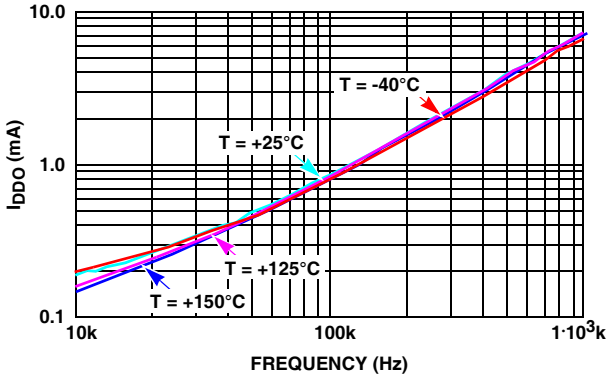


FIGURE 7. ISL2110 I_{DD} OPERATING CURRENT vs FREQUENCY

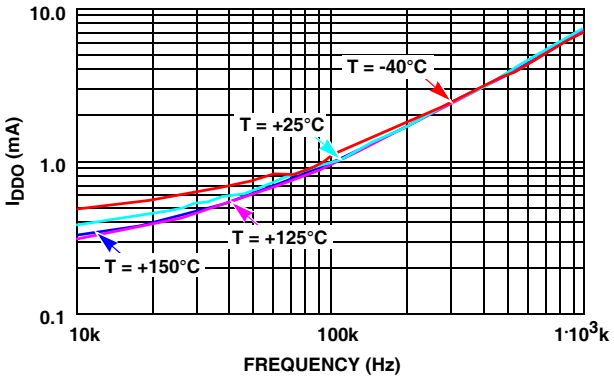


FIGURE 8. ISL2111 I_{DD} OPERATING CURRENT vs FREQUENCY

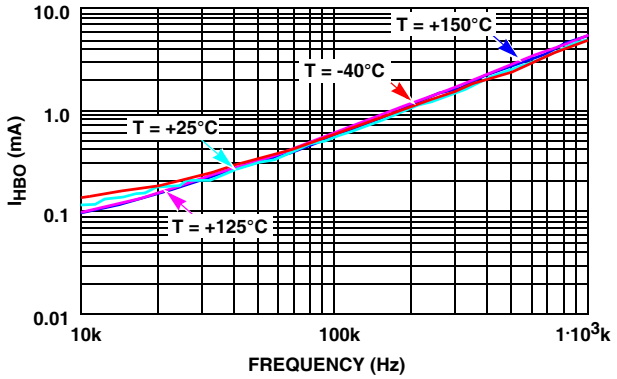


FIGURE 9. I_{HB} OPERATING CURRENT vs FREQUENCY

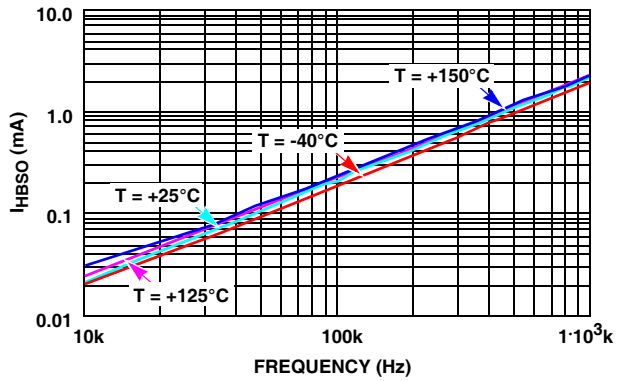


FIGURE 10. I_{HBS} OPERATING CURRENT vs FREQUENCY

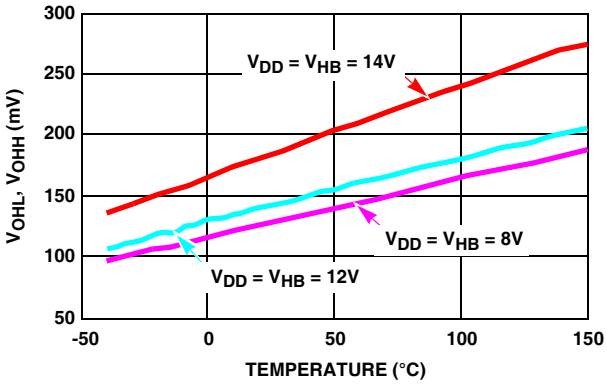


FIGURE 11. HIGH LEVEL OUTPUT VOLTAGE vs TEMPERATURE

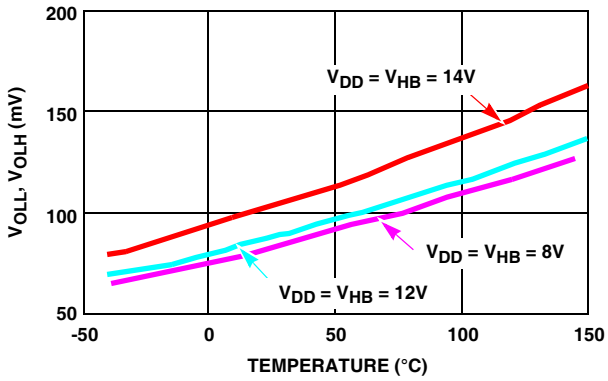


FIGURE 12. LOW LEVEL OUTPUT VOLTAGE vs TEMPERATURE

Typical Performance Curves (Continued)

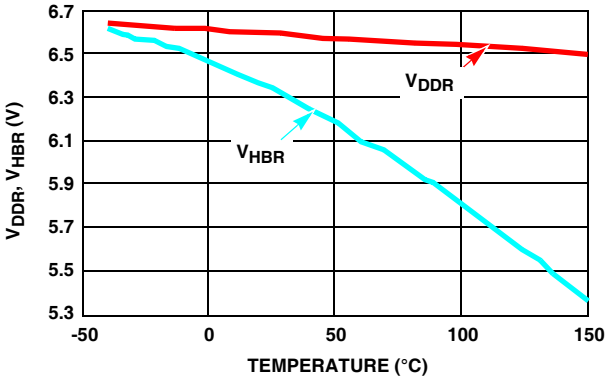


FIGURE 13. UNDERVOLTAGE LOCKOUT THRESHOLD vs TEMPERATURE

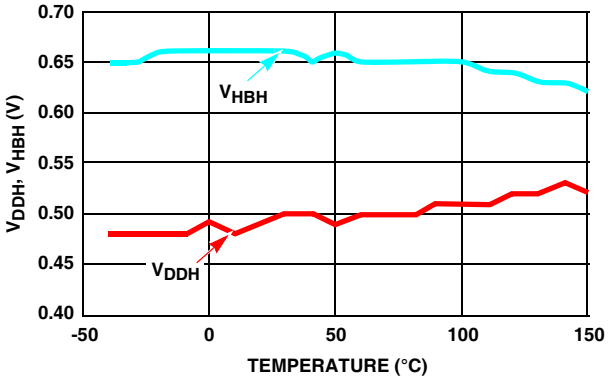


FIGURE 14. UNDERVOLTAGE LOCKOUT HYSTERESIS vs TEMPERATURE

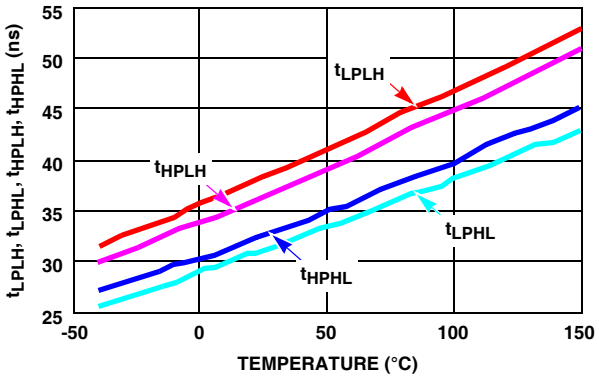


FIGURE 15. ISL2110 PROPAGATION DELAYS vs TEMPERATURE

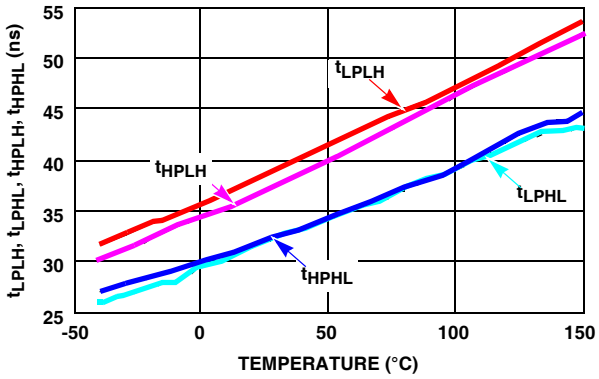


FIGURE 16. ISL2111 PROPAGATION DELAYS vs TEMPERATURE

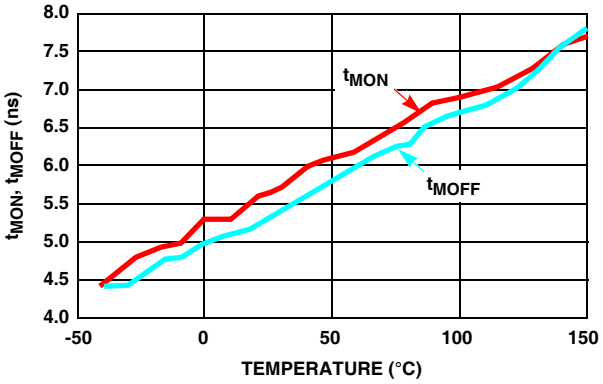


FIGURE 17. ISL2110 DELAY MATCHING vs TEMPERATURE

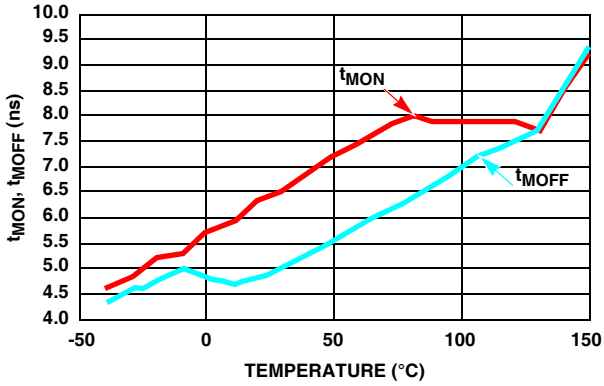


FIGURE 18. ISL2111 DELAY MATCHING vs TEMPERATURE

Typical Performance Curves (Continued)

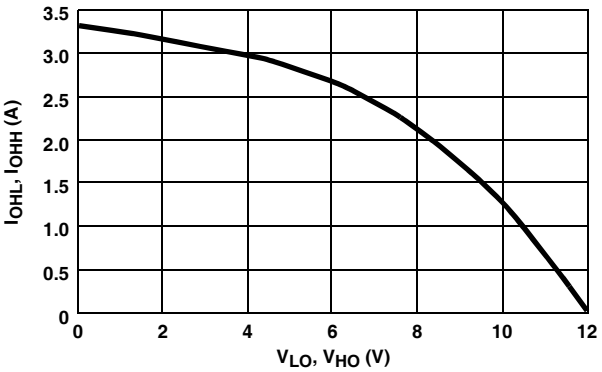


FIGURE 19. PEAK PULL-UP CURRENT vs OUTPUT VOLTAGE

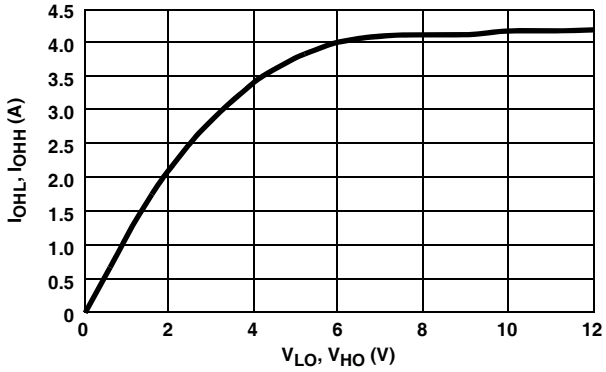


FIGURE 20. PEAK PULL-DOWN CURRENT vs OUTPUT VOLTAGE

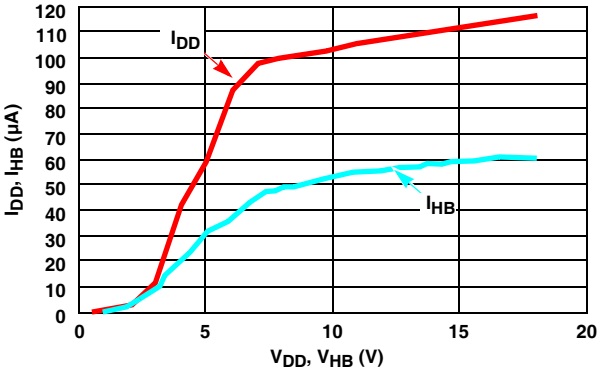


FIGURE 21. ISL2110 QUIESCENT CURRENT vs VOLTAGE

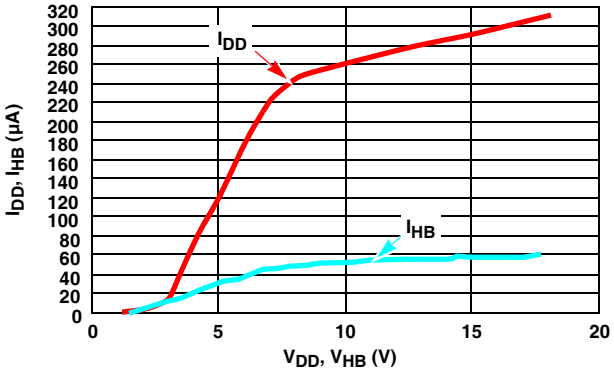


FIGURE 22. ISL2111 QUIESCENT CURRENT vs VOLTAGE

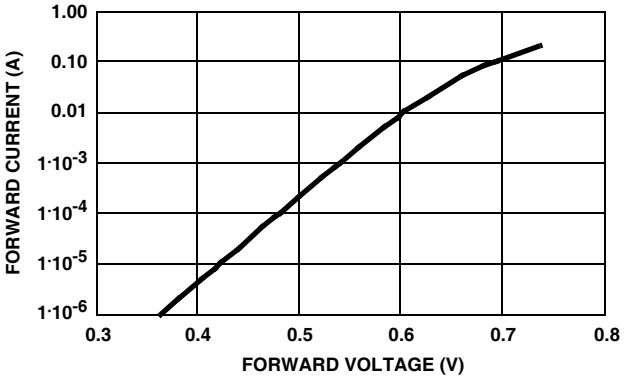


FIGURE 23. BOOTSTRAP DIODE I-V CHARACTERISTICS

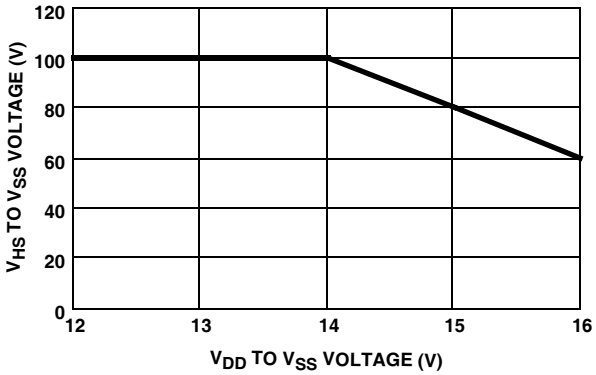


FIGURE 24. V_{HS} VOLTAGE vs V_{DD} VOLTAGE

Revision History

The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please visit our website to make sure you have the latest revision.

DATE	REVISION	CHANGE
Mar 16, 2017	FN6295.7	Corrected the branding of FG ISL2111BR4Z in the order information table from "211 1BR4A" to "211 1BR4Z". Added Revision History table and About Intersil information. Updated L10.4x4 Package Outline Drawing from Rev 1 to Rev 2. Change since Rev 1 is: “Tiebar note update from ‘Tiebar shown (if present) is a non-functional feature’ to ‘Tiebar shown (if present) is a non-functional feature and may be located on any of the 4 sides (or ends)’”. Updated L12.4x4A Package Outline Drawing from Rev 1 to Rev 3. Changes since Rev 1 are: “Tiebar note update from ‘Tiebar shown (if present) is a non-functional feature’ to ‘Tiebar shown (if present) is a non-functional feature and may be located on any of the 4 sides (or ends)’”; “Bottom View changed from ‘3.2 REF’ TO ‘2.5 REF’”; “Typical Recommended Land Pattern changed from ‘3.80’ to ‘3.75’”; “Updated to new POD format by removing table listing dimensions and moving dimensions onto drawing”, and “Added typical recommended land pattern”. Updated M8.15 Package Outline Drawing from Rev 3 to Rev 4. Change since Rev 3 is: “Changed Note 1 from 1982 to 1994“. Updated L8.4x4 Package Outline Drawing from Rev 0 to Rev 1. Change since Rev 0 is: “Tiebar note update from ‘Tiebar shown (if present) is a non-functional feature’ to ‘Tiebar shown (if present) is a non-functional feature and may be located on any of the 4 sides (or ends)’”.

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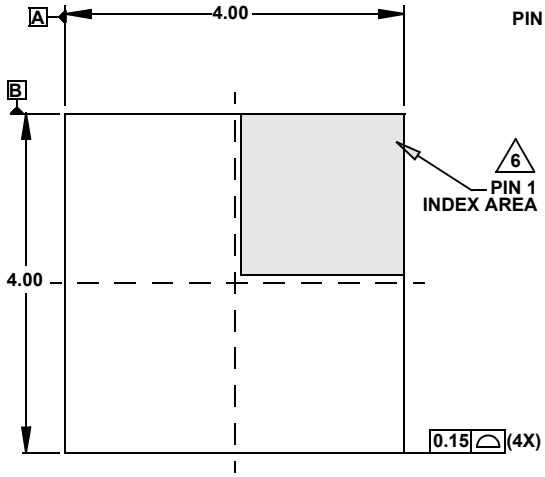
Package Outline Drawing

For the most recent package outline drawing, see L10.4x4.

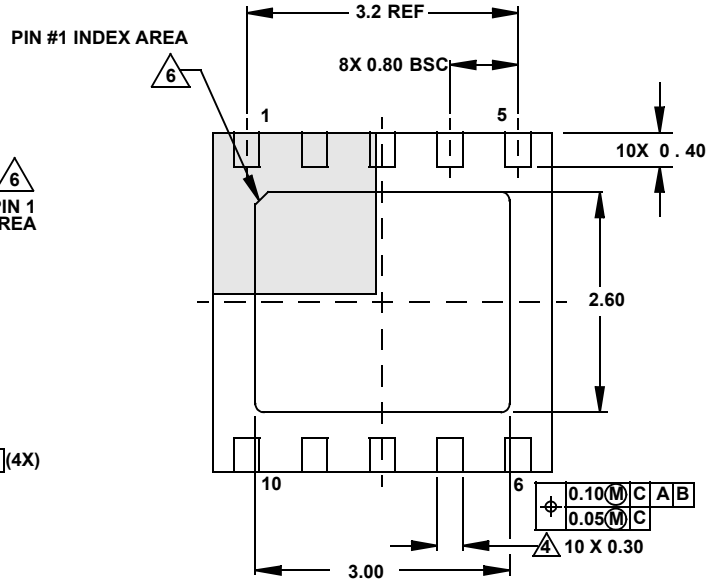
L10.4x4

10 LEAD THIN DUAL FLAT NO-LEAD PLASTIC PACKAGE

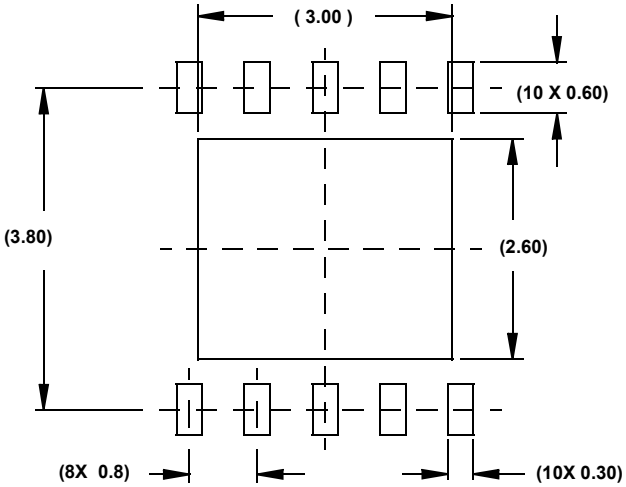
Rev 2, 4/15



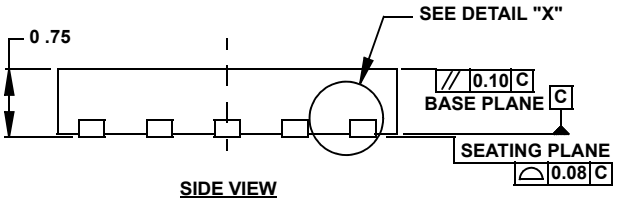
TOP VIEW



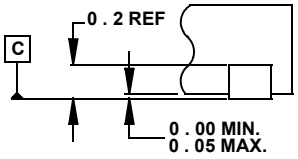
BOTTOM VIEW



TYPICAL RECOMMENDED LAND PATTERN



SIDE VIEW



DETAIL "X"

NOTES:

1. Dimensions are in millimeters.
   Dimensions in ( ) for Reference Only.
2. Dimensioning and tolerancing conform to AMSE Y14.5m-1994.
3. Unless otherwise specified, tolerance : Decimal ± 0.05
4. Dimension b applies to the metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip.
5. Tiebar shown (if present) is a non-functional feature and may be located on any of the 4 sides (or ends).
6. The configuration of the pin #1 identifier is optional, but must be located within the zone indicated. The pin #1 identifier may be either a mold or mark feature.

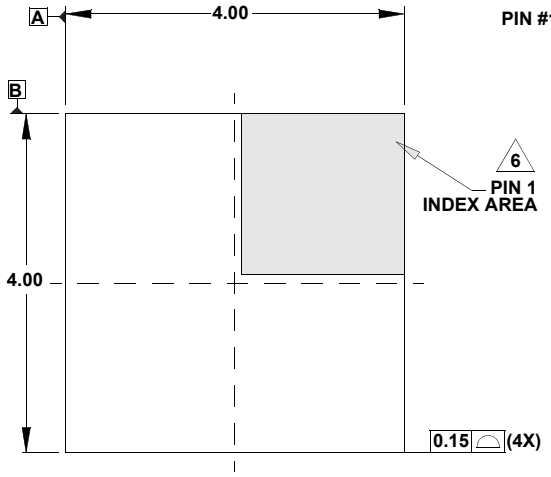
Package Outline Drawing

For the most recent package outline drawing, see L12.4x4A.

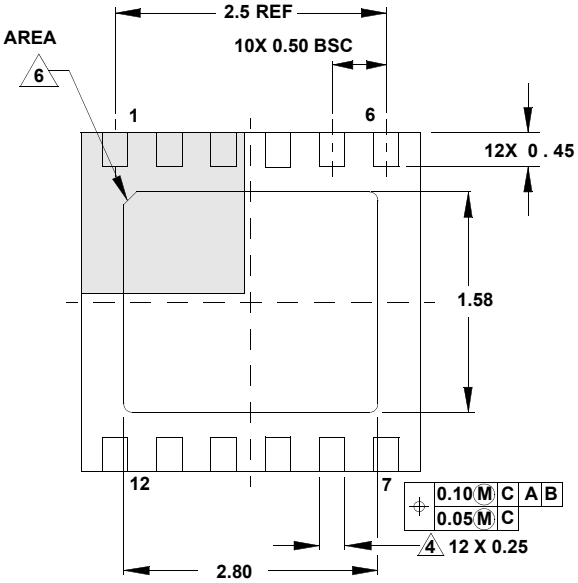
L12.4x4A

12 LEAD DUAL FLAT NO-LEAD PLASTIC PACKAGE

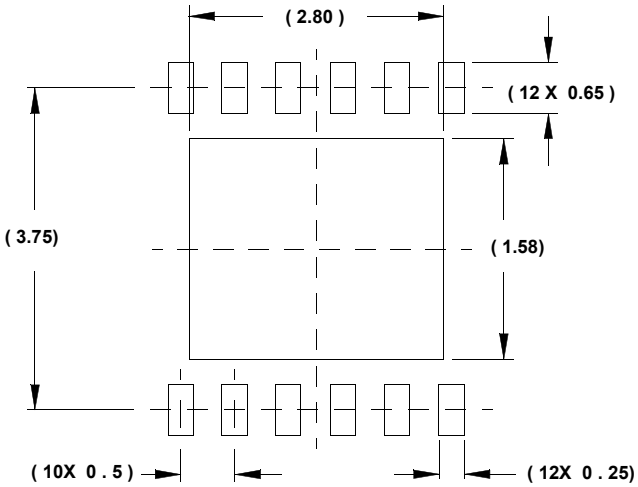
Rev 3, 3/15



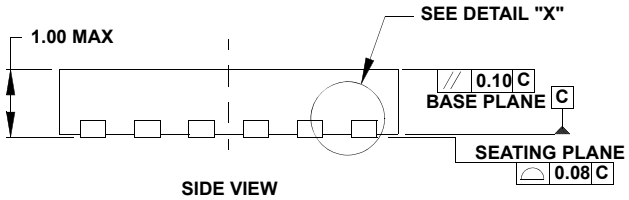
TOP VIEW



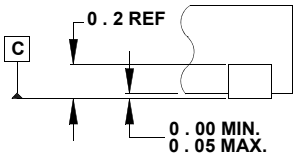
BOTTOM VIEW



TYPICAL RECOMMENDED LAND PATTERN



SIDE VIEW



DETAIL "X"

NOTES:

1. Dimensions are in millimeters.
   Dimensions in ( ) for Reference Only.
2. Dimensioning and tolerancing conform to AMSE Y14.5m-1994.
3. Unless otherwise specified, tolerance : Decimal ± 0.05
4. Lead width applies to the metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip.
5. Tiebar shown (if present) is a non-functional feature and may be located on any of the 4 sides (or ends).
6. The configuration of the pin #1 identifier is optional, but must be located within the zone indicated. The pin #1 identifier may be either a mold or mark feature.

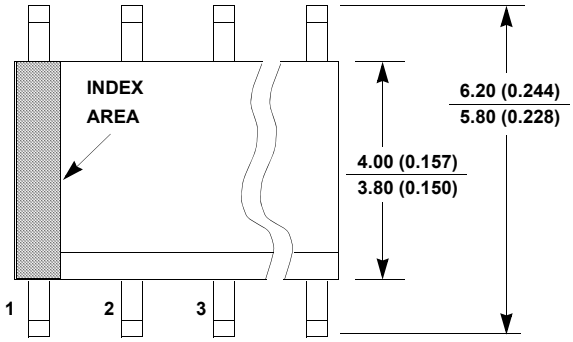
Package Outline Drawing

For the most recent package outline drawing, see M8.15.

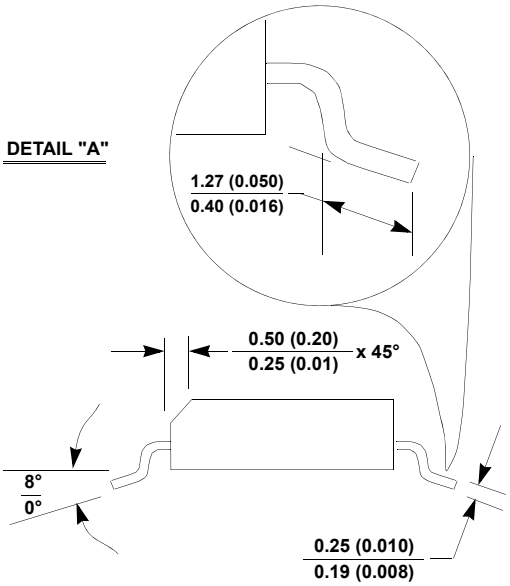
M8.15

8 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

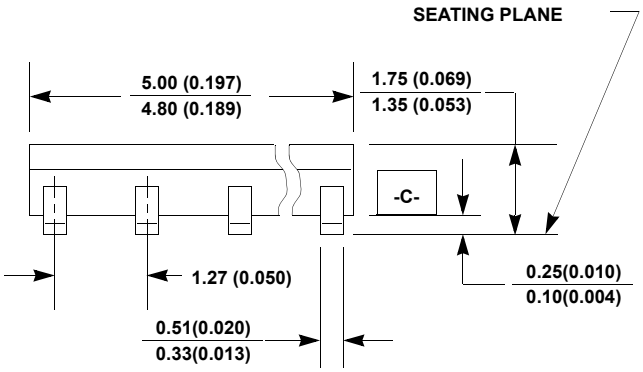
Rev 4, 1/12



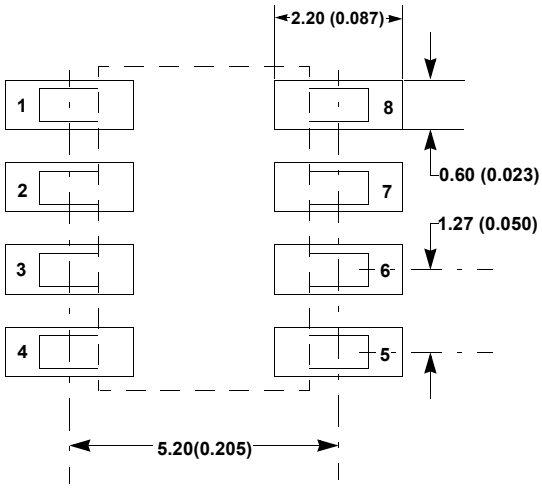
TOP VIEW



SIDE VIEW "B"



SIDE VIEW "A"



TYPICAL RECOMMENDED LAND PATTERN

NOTES:

1. Dimensioning and tolerancing per ANSI Y14.5M-1994.
2. Package length does not include mold flash, protrusions or gate burrs. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.
3. Package width does not include interlead flash or protrusions. Interlead flash and protrusions shall not exceed 0.25mm (0.010 inch) per side.
4. The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.
5. Terminal numbers are shown for reference only.
6. The lead width as measured 0.36mm (0.014 inch) or greater above the seating plane, shall not exceed a maximum value of 0.61mm (0.024 inch).
7. Controlling dimension: MILLIMETER. Converted inch dimensions are not necessarily exact.
8. This outline conforms to JEDEC publication MS-012-AA ISSUE C.

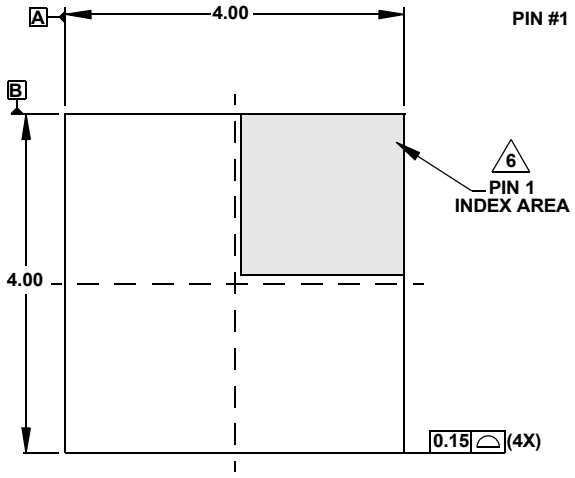
Package Outline Drawing

For the most recent package outline drawing, see L8.4x4.

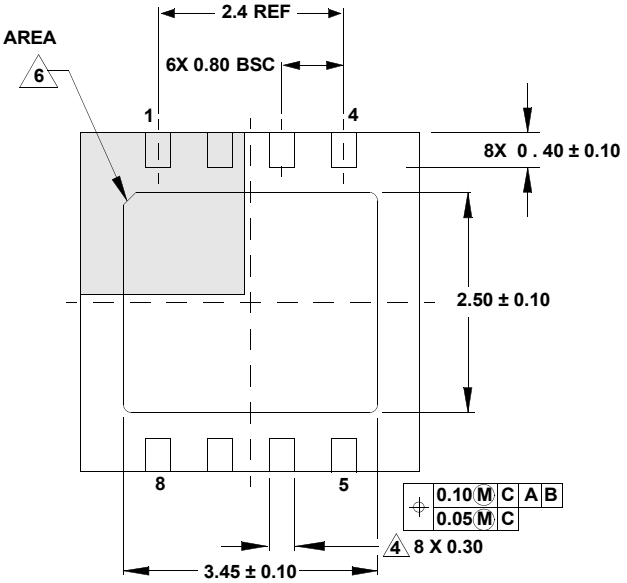
L8.4x4

8 LEAD DUAL FLAT NO-LEAD PLASTIC PACKAGE

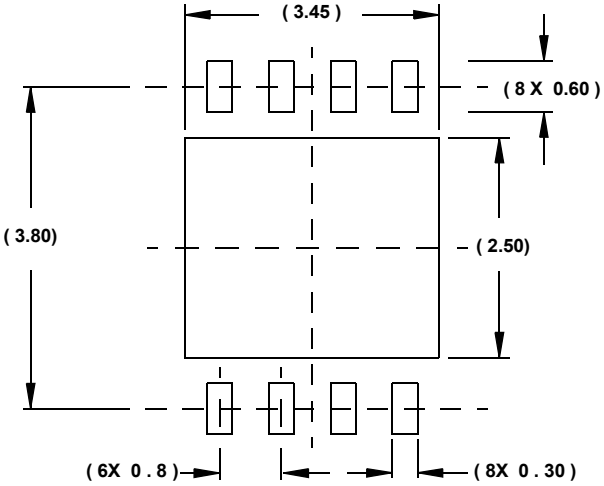
Rev 1, 03/15



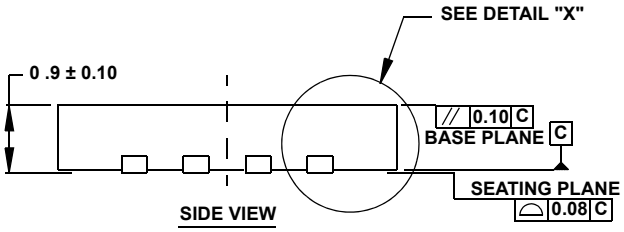
TOP VIEW



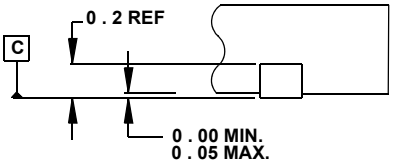
BOTTOM VIEW



TYPICAL RECOMMENDED LAND PATTERN



SIDE VIEW



DETAIL "X"

NOTES:

1. Dimensions are in millimeters.
   Dimensions in ( ) for Reference Only.
2. Dimensioning and tolerancing conform to ASME Y14.5m-1994.
3. Unless otherwise specified, tolerance : Decimal ± 0.05
4. Dimension applies to the metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip.
5. Tiebar shown (if present) is a non-functional feature and may be located on any of the 4 sides (or ends).
6. The configuration of the pin #1 identifier is optional, but must be located within the zone indicated. The pin #1 identifier may be either a mold or mark feature.