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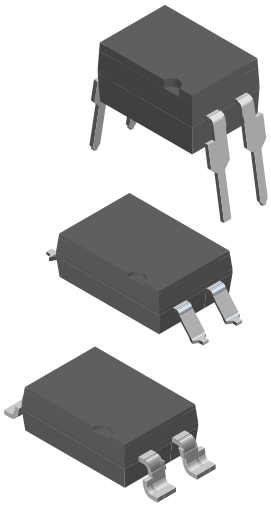
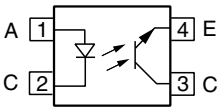
Optocoupler, Phototransistor Output, High Reliability, 5300 V_{RMS}





FEATURES

- Good CTR linearity depending on forward current
- Isolation test voltage, 5300 V_{RMS}
- High collector emitter voltage, V_{CEO} = 70 V
- Low saturation voltage
- Fast switching times
- Low CTR degradation
- Temperature stable
- Low coupling capacitance
- End stackable, 0.100" (2.54 mm) spacing
- High common mode interference immunity
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The SFH610A and SFH6106 feature a high current transfer ratio, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic DIP-4 or SMD package.

The coupling devices are designed for signal transmission between two electrically separated circuits.

The couplers are end-stackable with 2.54 mm spacing.

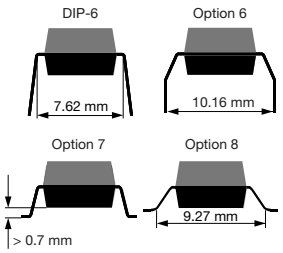
Creepage and clearance distances of > 8.0 mm are achieved with option 6 and option 8. This version complies with IEC 60950 (DIN VDE 0805) for reinforced insulation up to an operation voltage of 400 V_{RMS} or DC. Specifications subject to change.

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 (VDE 0884) available with option 1
- CSA 93751
- BSI IEC 60950; IEC 60065

ORDERING INFORMATION

S	F	H	6	1	0	x	-	#	X	0	#	#	T
PART NUMBER								CTR BIN	PACKAGE OPTION				TAPE AND REEL



AGENCY CERTIFIED/PACKAGE	CTR (%)				
UL, BSI, CSA	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**	**250 to 500**
DIP-4	SFH610A-1	SFH610A-2	SFH610A-3	SFH610A-4	SFH610A-5
DIP-4, 400 mil	SFH610A-1X006	SFH610A-2X006	SFH610A-3X006	SFH610A-4X006	-
SMD-4	SFH6106-1	SFH6106-2	SFH6106-3	SFH6106-4	SFH6106-5T
SMD-4, option 7	-	-	SFH610A-3X007	-	-
VDE, UL, BSI, CSA (option 1)	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**	**250 to 500**
SMD-4, 400 mil, option 8	SFH610A-1X018T	-	-	-	-

Note

- For additional information on the available options refer to option information.

For technical questions, contact: optocoupleranswers@vishay.com

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
DC forward current		I_F	60	mA
Surge forward current	t ≤ 10 µs	I_{FSM}	2.5	A
Power dissipation		P_{diss}	100	mW
OUTPUT				
Collector emitter voltage		V_{CEO}	70	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
	t_p ≤ 1.0 ms	I_C	100	mA
Power dissipation		P_{diss}	150	mW
COUPLER				
Storage temperature range		T_{stg}	-55 to +150	°C
Ambient temperature range		T_{amb}	-55 to +100	°C
Soldering temperature (1)	max. 10 s, dip soldering distance to seating plane ≥ 1.5 mm	T_{sld}	260	°C

Notes

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(1) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 60 mA		V_F	-	1.25	1.65	V
Reverse current	V_R = 6 V		I_R	-	0.01	10	µA
Capacitance	V_R = 0 V, f = 1 MHz		C_O	-	13	-	pF
Thermal resistance			R_{thja}	-	750	-	K/W
OUTPUT							
Collector emitter capacitance	V_{CE} = 5 V, f = 1 MHz		C_{CE}	-	5.2	-	pF
Thermal resistance			R_{thja}	-	500	-	K/W
Collector emitter leakage current	V_{CE} = 10 V	SFH610A-1	I_{CEO}	-	2	50	nA
		SFH6106-1	I_{CEO}	-	2	50	nA
		SFH610A-2	I_{CEO}	-	2	50	nA
		SFH6106-2	I_{CEO}	-	2	50	nA
		SFH610A-3	I_{CEO}	-	5	100	nA
		SFH6106-3	I_{CEO}	-	5	100	nA
		SFH610A-4	I_{CEO}	-	5	100	nA
		SFH6106-4	I_{CEO}	-	5	100	nA
		SFH610A-5	I_{CEO}	-	5	100	nA
		SFH6106-5T	I_{CEO}	-	5	100	nA
COUPLER							
Collector emitter saturation voltage	I_F = 10 mA, I_C = 2.5 mA		V_{CEsat}	-	0.25	0.4	V
Coupling capacitance	f = 1 MHz		C_C	-	0.4	-	pF

Note

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

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CURRENT TRANSFER RATIO							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	I_F = 10 mA, V_{CE} = 5.0 V	SFH610A-1	CTR	40	-	80	%
		SFH6106-1	CTR	40	-	80	%
		SFH610A-2	CTR	63	-	125	%
		SFH6106-2	CTR	63	-	125	%
		SFH610A-3	CTR	100	-	200	%
		SFH6106-3	CTR	100	-	200	%
		SFH610A-4	CTR	160	-	320	%
		SFH6106-4	CTR	160	-	320	%
		SFH610A-5	CTR	250	-	500	%
		SFH6106-5	CTR	250	-	500	%
	I_F = 1 mA, V_{CE} = 5 V	SFH610A-1	CTR	13	30	-	%
		SFH6106-1	CTR	13	30	-	%
		SFH610A-2	CTR	22	45	-	%
		SFH6106-2	CTR	22	45	-	%
		SFH610A-3	CTR	34	70	-	%
		SFH6106-3	CTR	34	70	-	%
		SFH610A-4	CTR	56	90	-	%
		SFH6106-4	CTR	56	90	-	%

SWITCHING CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
NON-SATURATED							
Current	V_{CC} = 5 V, R_L = 75 Ω		I_F	-	10	-	mA
Rise time	V_{CC} = 5 V, R_L = 75 Ω		t_r	-	2	-	µs
Fall time	V_{CC} = 5 V, R_L = 75 Ω		t_f	-	2	-	µs
Turn-on time	V_{CC} = 5 V, R_L = 75 Ω		t_{on}	-	3	-	µs
Turn-off time	V_{CC} = 5 V, R_L = 75 Ω		t_{off}	-	2.3	-	µs
Cut-off frequency	V_{CC} = 5 V		F_{CO}	-	250	-	kHz
SATURATED							
Current		SFH610A-1	I_F	-	20	-	mA
		SFH6106-1					
		SFH610A-2	I_F	-	10	-	mA
		SFH6106-2					
		SFH610A-3	I_F	-	10	-	mA
		SFH6106-3					
		SFH610A-4	I_F	-	5	-	mA
		SFH6106-4					
SATURATED							
Rise time		SFH610A-1	t_r	-	2	-	µs
		SFH6106-1					
		SFH610A-2	t_r	-	3	-	µs
		SFH6106-2					
		SFH610A-3	t_r	-	3	-	µs
		SFH6106-3					
		SFH610A-4	t_r	-	4	-	µs
		SFH6106-4					

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SWITCHING CHARACTERISTICS

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Fall time		SFH610A-1	t_f	-	11	-	µs
		SFH6106-1					
		SFH610A-2	t_f	-	14	-	µs
		SFH6106-2					
		SFH610A-3	t_f	-	14	-	µs
		SFH6106-3					
		SFH610A-4	t_f	-	15	-	µs
		SFH6106-4					
Turn-on time		SFH610A-1	t_{on}	-	3	-	µs
		SFH6106-1					
		SFH610A-2	t_{on}	-	4.2	-	µs
		SFH6106-2					
		SFH610A-3	t_{on}	-	4.2	-	µs
		SFH6106-3					
		SFH610A-4	t_{on}	-	6	-	µs
		SFH6106-4					
Turn-off time		SFH610A-1	t_{off}	-	18	-	µs
		SFH6106-1					
		SFH610A-2	t_{off}	-	23	-	µs
		SFH6106-2					
		SFH610A-3	t_{off}	-	23	-	µs
		SFH6106-3					
		SFH610A-4	t_{off}	-	25	-	µs
		SFH6106-4					

Note

- All values presented are typical values.

SAFETY AND INSULATION RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55 / 100 / 21	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V_{ISO}	4420	V_{RMS}
Tested withstanding isolation voltage	According to UL1577, t = 1 s	V_{ISO}	5300	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	10 000	V
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	890	V
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	400	mW
Input safety current		I_{SI}	275	mA
Input safety temperature		T_{SI}	175	°C
Creepage distance	DIP-4 / SMD-4		≥ 7	mm
Clearance distance			≥ 7	mm
Creepage distance	DIP-4, 400 mil / SMD-4, 400 mil		≥ 8	mm
Clearance distance			≥ 8	mm
Insulation thickness		DTI	≥ 0.4	mm

Note

- As per IEC 60747-5-5, § 7.4.3.8.2, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

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TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

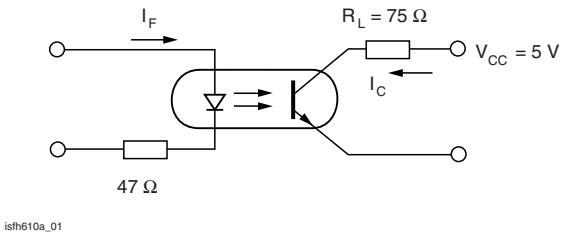

Fig. 1 - Linear Operation (without saturation)

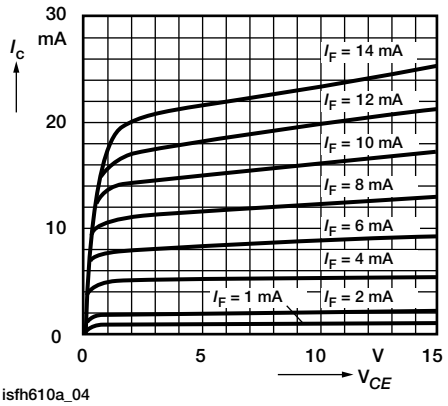

Fig. 4 - Output Characteristics (typ.) Collector Current vs. Collector Emitter Voltage

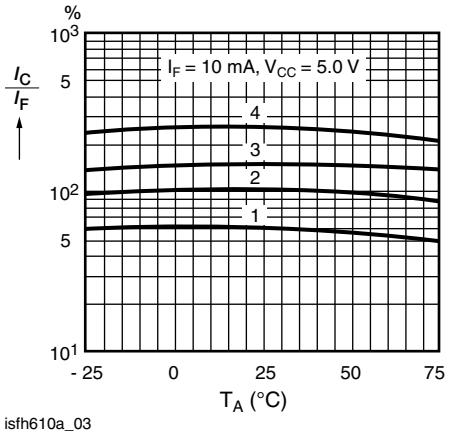

Fig. 2 - Current Transfer Ratio (CTR) vs. Temperature

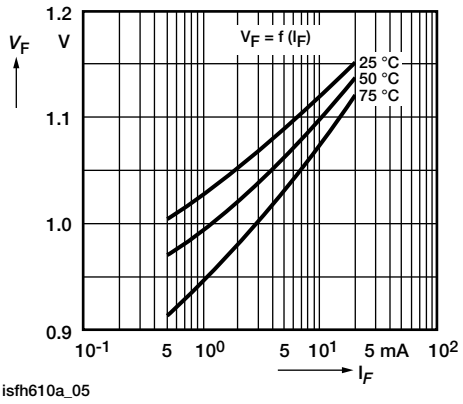

Fig. 5 - Diode Forward Voltage vs. Forward Current

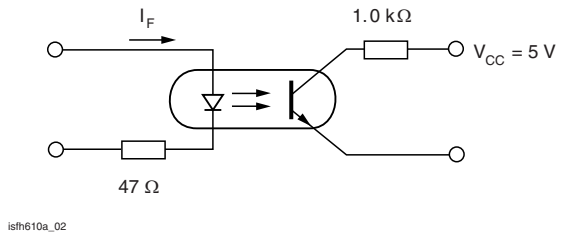

Fig. 3 - Switching Operation (with saturation)

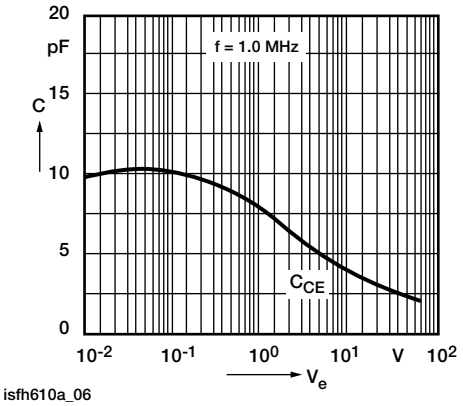

Fig. 6 - Transistor Capacitance (typ.) vs. Collector Emitter Voltage

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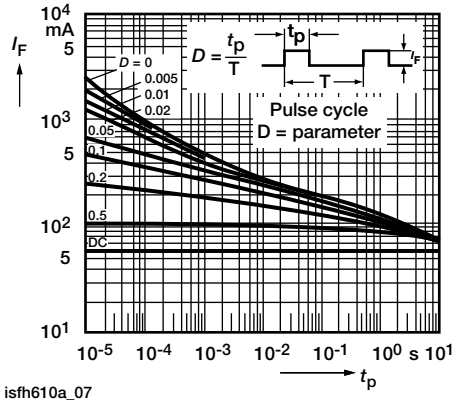

Fig. 7 - Permissible Pulse Handling Capability Forward Current vs. Pulse Width

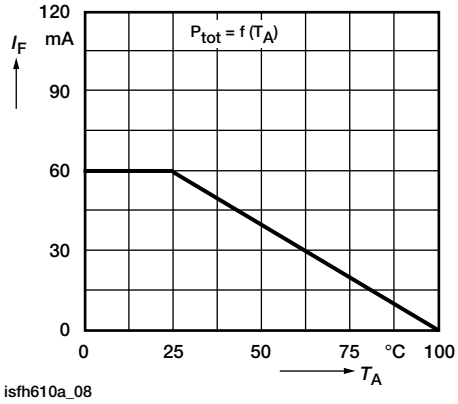

Fig. 8 - Permissible Power Dissipation vs. Temperature

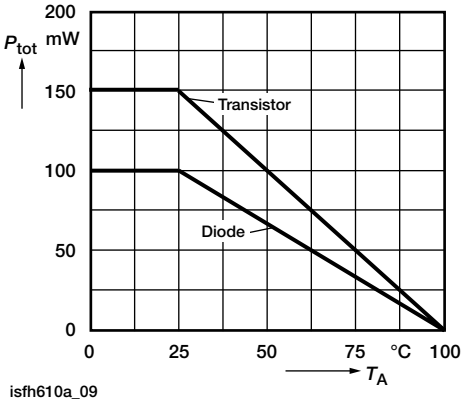

Fig. 9 - Permissible Diode Forward Current vs. Ambient Temperature

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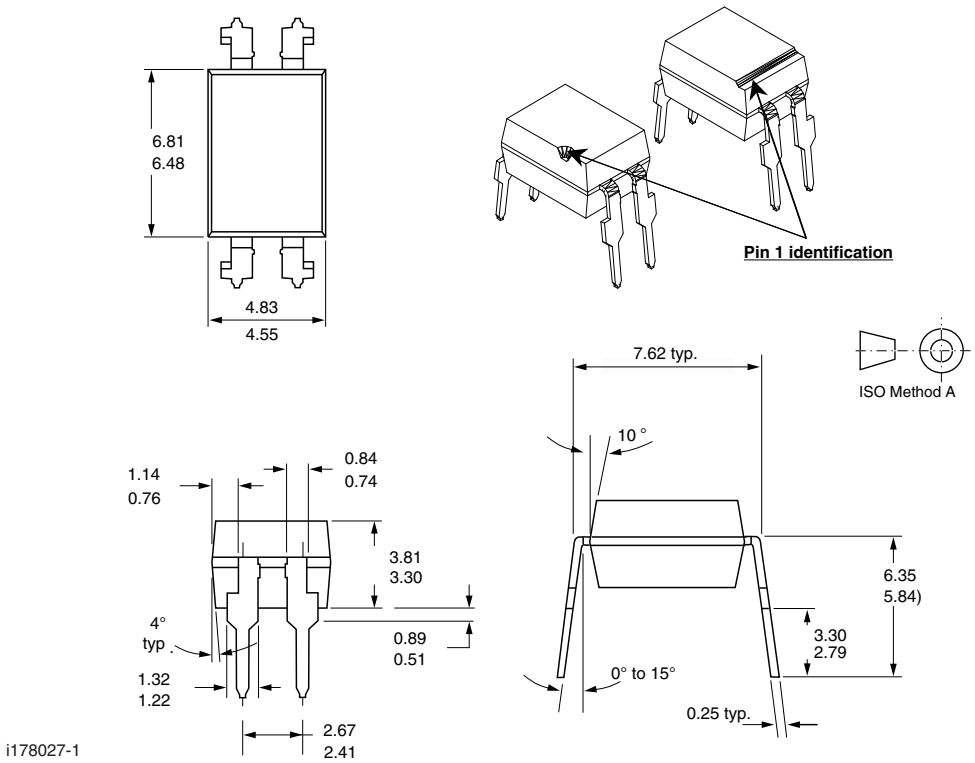
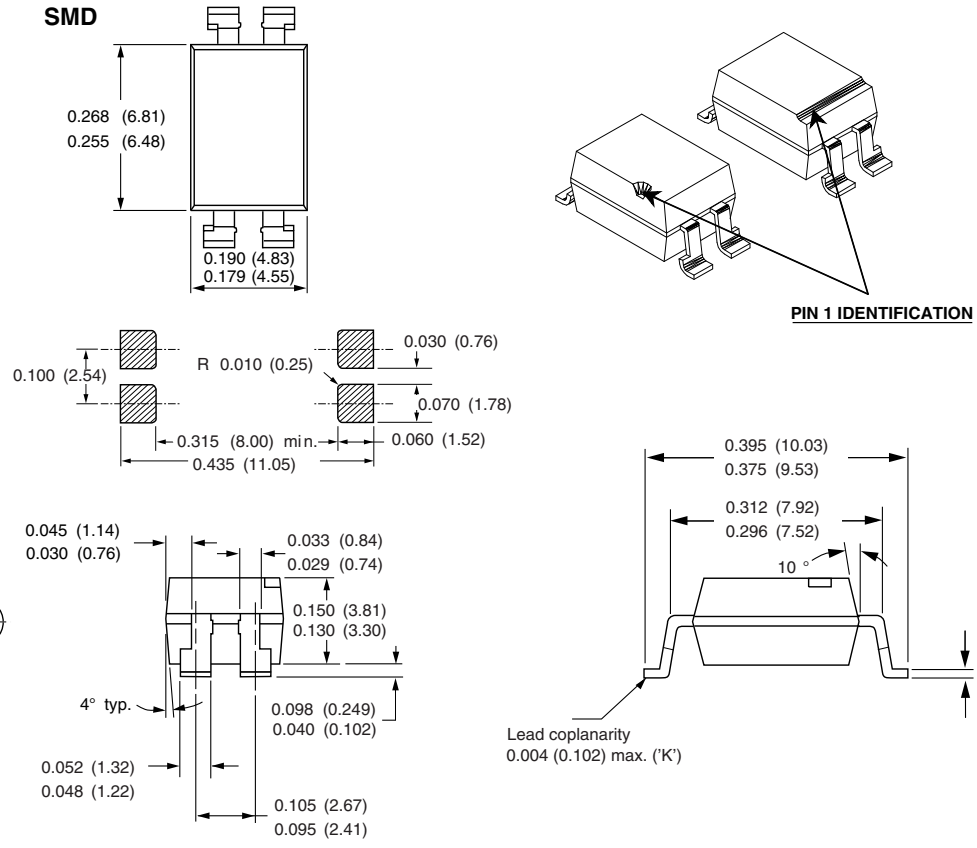
PACKAGE DIMENSIONS in inches (millimeters)



SMD



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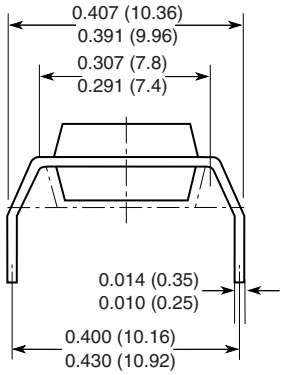
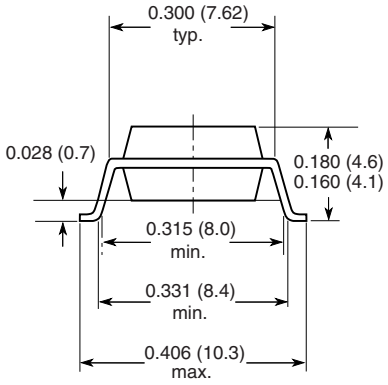
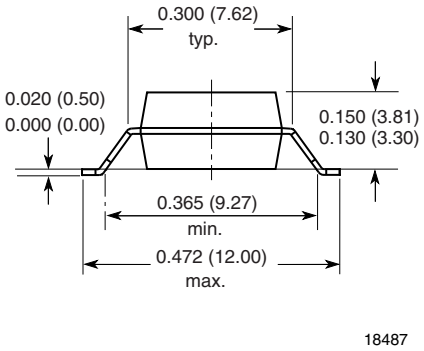
Option 6



Option 7



Option 8



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