Liteon Semiconductor Corporation

LSP3127

52KHZ 2A PWM Buck DC/DC Converter

■ FEATURES

- Output voltage: 3.3V, 5.0V, 12V, and adjustable output version
- Adjustable version output voltage range:1.23V to 37V±4%
- 52KHz±15% fixed switching frequency
- Voltage mode non-synchronous PWM control
- Thermal-shutdown and current-limit protection
- ON/OFF shutdown control input
- Operating voltage can be up to 40V
- Output load current: 2A
- Low power standby mode
- Built-in switching transistor on chip
- SOP8-EP package

■ APPLICATIONS

- Simple High-efficiency step-down regulator
- On-card switching regulators
- Positive to negative converter

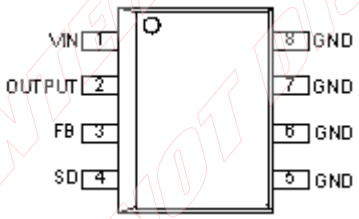
■ GENERAL DESCRIPTION

The LSP3127 series are monolithic IC that design for a step-down DC/DC converter, and own the ability of driving a 2A load without additional transistor component. Due to reducing the number of external component, the board space can be saved easily. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes feedback control have good line and load regulation without external design. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is against over current operating of the output switch. The LSP3127 series operates at a switching frequency of 52 KHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed ±4% tolerance on output voltage under specified input voltage and output load conditions, and ±15% on the oscillator frequency. The output version included fixed 3.3V, 5V, 12V, and an adjustable type. The package is available in a standard SOP8-EP package.

■ PIN CONFIGURATION

SOP8-EP

(Top View)



■ PIN DESCRIPTION

Name	No.	Description
VIN	1	Operating Voltage Input
OUTPUT	2	Switching Output
FB	3	Output Voltage Feedback Control
SD	4	On/Off Shutdown
GND	5	Ground
GND	6	Ground
GND	7	Ground
GND	8	Ground

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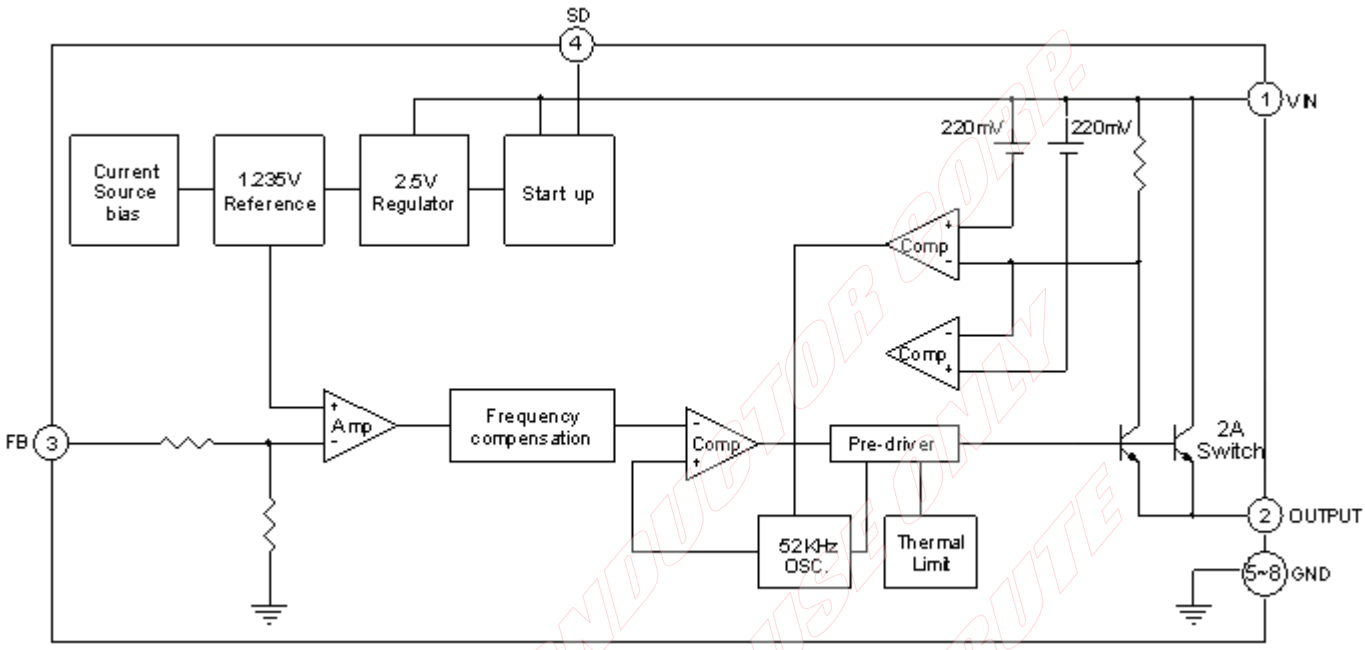
■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

Symbol	Paramrter	Rating	Unit
V_{CC}	Supply Voltage	+45	V
V_{SD}	ON/OFF Pin input Voltage	-0.3 to +25	V
V_{FB}	Feedback Pin Voltage	-0.3 to +25	V
V_{OUT}	Output Voltage to Ground	-1	V
P_D	Power Dissipation	Internally Limited	W
T_{ST}	Storage Temperature	-65 to +150	℃
T_{OP}	Operating Temperature	-40 to +125	℃
V_{OP}	Operating Voltage	+4.5 to +40	V

■ ELECTRICAL CHARACTERISTICS (ALL OUTPUT VOLTAGE VERSIONS)

Unless otherwise specified, V_{IN}=12V for 3.3V,5V, adjustable version and V_{IN}=24V for the 12V version. I_{LOAD}=0.5A

Symbol	Paramrter		Conditions	Min.	Typ.	Max.	Unit
I_B	Feedback bias current		V_{FB}=1.3V(Adjustable version only)		40	50 100	nA
F_{OSC}	Oscillator frequency			44 **38**	52	60 **66**	KHz
V_{SAT}	Saturation voltage		I_{OUT}=2A no outside circuit V_{FB}=0V force driver on		1.4	1.8	V
DC	Max.Duty Cycle(ON)		V_{FB}=0V force driver on			100	%
	Min.Duty Cycle(OFF)		V_{FB}=12V force driver off	0			
I_{CL}	Current limit		Peak current no outside circuit V_{FB}=0V force driver on		5.8		A
I_L	Output=0	Output leakage current	no outside circuit V_{FB}=12V force driver off			2	mA
	Output=-1		V_{IN}=40V			30	mA
I_Q	Quiescent Current		V_{FB}=12V force driver off		5	10	mA
I_{STBY}	Standby Quiesient Current		ON/OFF Pin=5V V_{IN}=40V		80	200	μA
V_{IL}	ON/OFF pin logic input threshold voltage		Low(regultaor ON)		1.4	0.8	V
V_{IH}			High(regultaor OFF)	2.4			
I_H	ON/OFF pin logic input current		V_{LOGIC}=2.5V(OFF)			30	μA
I_L	ON/OFF pin input current		V_{LOGIC}=0.5V(ON)			10	
θ_{JC}	Thermal Resistence		SOP8-EP	Junction to case	10		℃/W
θ_{JA}	Thermal Resistence With copper area of approximately 3 in^2		SOP8-EP	Junction to ambient	50		℃/W

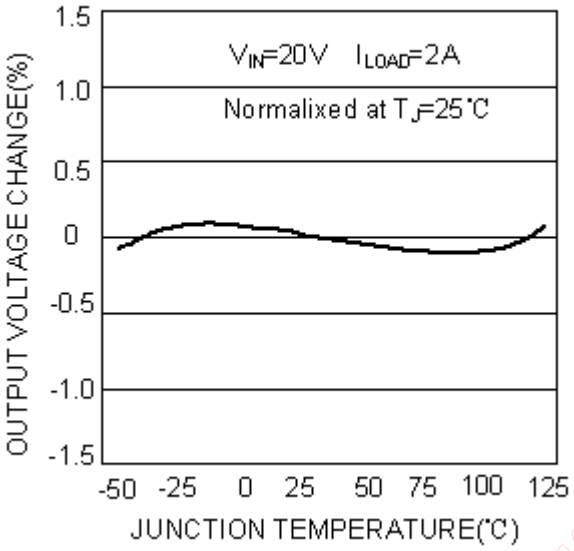
■ ELECTRICAL CHARACTERISTICS (CONTINUED)

Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Output Feedback	LSP3127-ADJ	V_{FB}	4.5V ≤V_{IN} ≤22V 0.2A ≤I_{LOAD} ≤2A V_{OUT} Programmed for 3V	1.193 **1.18**	1.23	1.267 **1.28**	V
Efficiency		η	V_{IN} =12V, I_{LOAD}= 2A	76			%
Output Feedback	LSP3127-3.3V	V_{FB}	4.5V ≤V_{IN} ≤22V 0.2A ≤I_{LOAD} ≤2A	3.168 **3.135**	3.3	3.432 **3.465**	V
Efficiency		η	V_{IN} =12V, I_{LOAD}= 2A	78			%
Output Feedback	LSP3127-5.0V	V_{FB}	7V ≤V_{IN} ≤22V 0.2A ≤I_{LOAD} ≤2A	4.8 **4.75**	5	5.2 **5.25**	V
Efficiency		η	V_{IN} =12V, I_{LOAD}= 2A	83			%
Output Feedback	LSP3127-12V	V_{FB}	15V ≤V_{IN} ≤22V 0.2A ≤I_{LOAD} ≤2A	11.52 **12.48**	12	11.4 **12.6**	V
Efficiency		η	V_{IN} =15V, I_{LOAD}= 2A	90			%

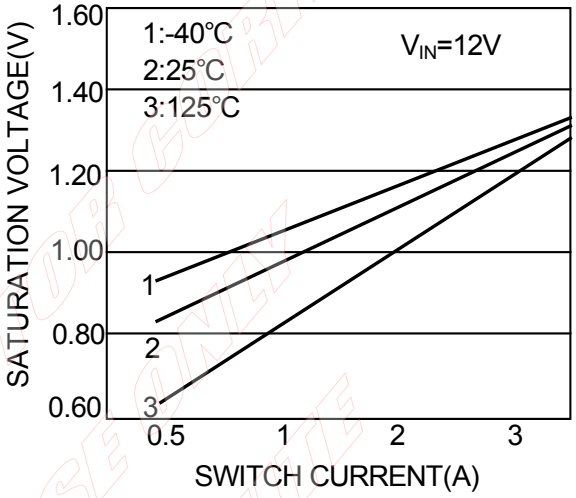
Specifications with boldface are for full operating temperature range, the other type are for T_J=25°C

■ TYPICAL PERFORMANCE CHARACTERISTICS

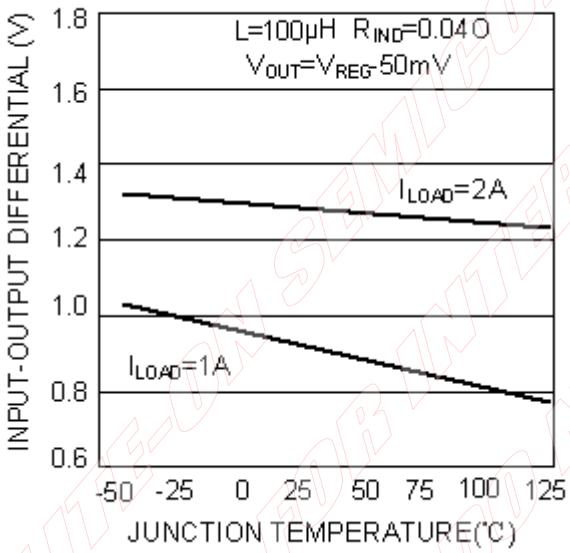
Normalized Output Voltage



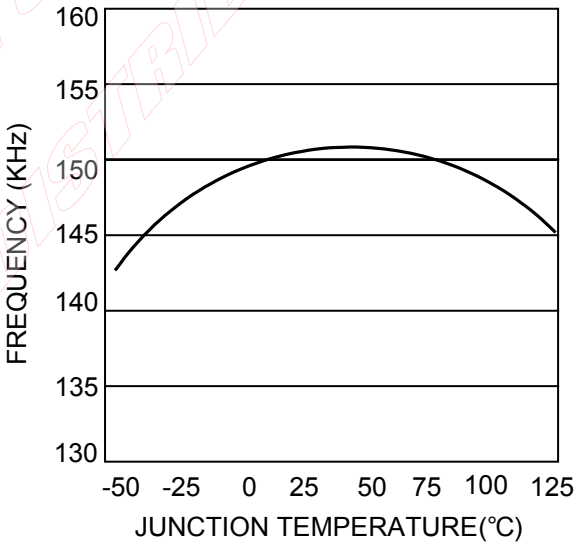
Switch Saturation Voltage



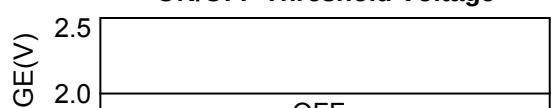
Dropout Voltage



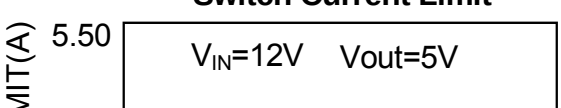
Switching Frequency



ON/OFF Threshold Voltage

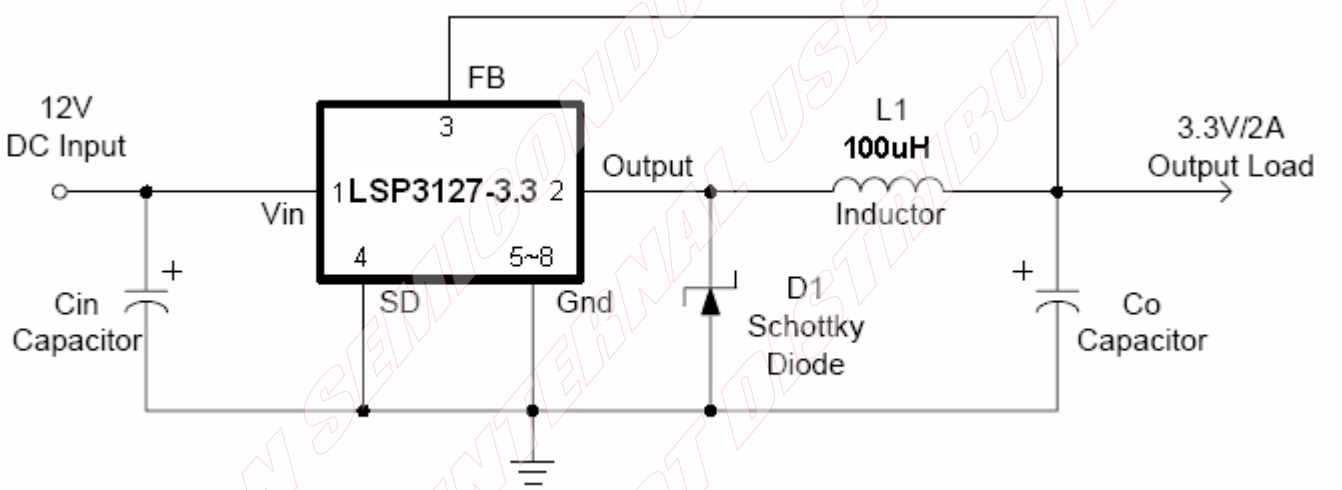


Switch Current Limit



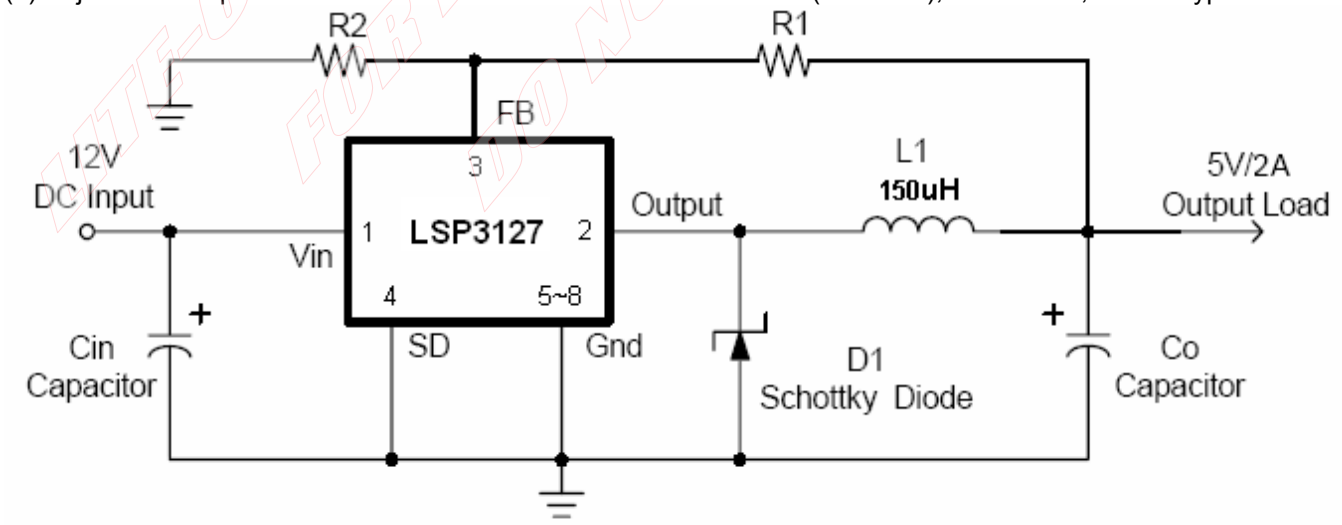
■ TYPICAL APPLICATION CIRCUITS

(1) Fixed Output Circuit



(2) Adjustable Output Circuit

Vout=V_{FB}*(1+R1/R2); V_{FB}=1.23V; R2=1K typical



Remark: For input-output voltage greater than approximately 15V the additional capacitor CFF 100nF is recommended between FB and Vout. The capacitor type can be ceramic, plastic, etc.

■ FUNCTION DESCRIPTION

Pin Function

V_{IN}

This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be present at this pin to minimize voltage transients and to supply the switching currents needed by the regulator.

Ground

Circuit ground.

Output

Internal switch. The voltage at this pin switches between ($V_{IN} - V_{SAT}$) and approximately – 0.5V, with a duty cycle of approximately V_{OUT} / V_{IN}. To minimize coupling to sensitive circuitry, the PC board copper area connected to this pin should be kept a minimum.

Feedback

Senses the regulated output voltage to complete the feedback loop.

ON/OFF

Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 150uA. Pulling this pin below a threshold voltage of approximately 1.3V turns the regulator on, and pulling this pin above 1.3V (up to a maximum of 25V) shuts the regulator down. If this shutdown feature is not needed, the ON/OFF pin can be wired to the ground pin or it can be left open, in either case the regulator will be in the ON condition.

Thermal Considerations

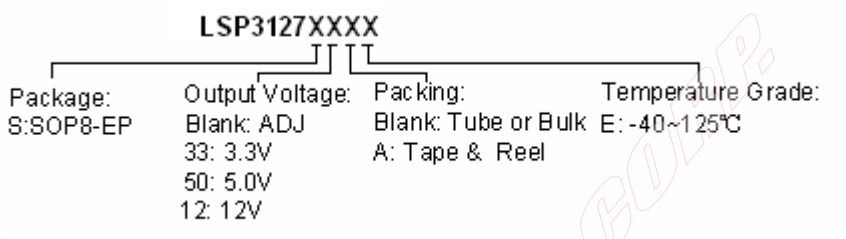
The SOP8L package needs a heat sink under most conditions. The size of the heatsink depends on the input voltage, the output voltage, the load current and the ambient temperature. The LSP3127 junction temperature rises above ambient temperature for a 2A load and different input and output voltages. The data for these curves was taken with the LSP3127(SOP8L package) operating as a buck-switching regulator in an ambient temperature 25°C (still air). These temperature increments are all approximate and are affected by many factors. Higher ambient temperatures requires more heat sinker.

For the best thermal performance, wide copper traces and generous amounts of printed circuit board copper should be used in the board layout. (One exception is the output (switch) pin, which should not have large areas of copper.) Large areas of copper provide the best transfer of heat (lower thermal resistance) to the surrounding air, and moving air lowers the thermal resistance even further.

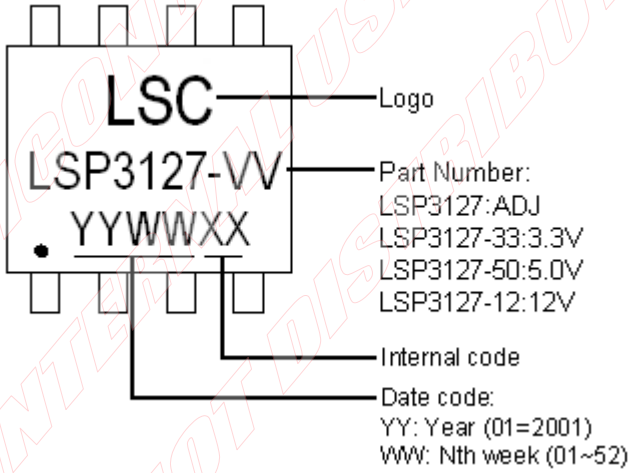
Package thermal resistance and junction temperature increments are all approximate. The increments are affected by a lot of factors. Some of these factors include board size, shape, thickness, position, location, and even board temperature. Other factors are, trace width, total printed circuit copper area, copper thickness, single or double-sided, multi-layer board and the amount of solder on the board.

The effectiveness of the PC board to dissipate heat also depends on the size, quantity and spacing of other components on the board, as well as whether the surrounding air is still or moving. Furthermore, some of these components such as the catch diode will add heat to the PC board and the heat can vary as the input voltage changes. For the inductor, depending on the physical size, type of core material and the DC resistance, it could either act as a heat sink taking heat away from the board, or it could add heat to the board.

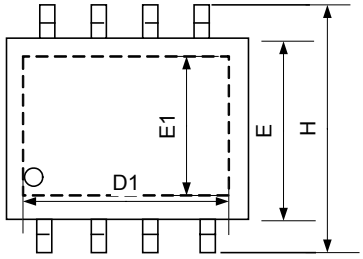
■ ORDERING INFORMATION

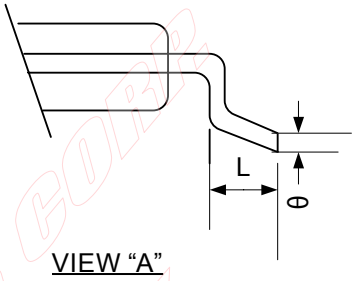


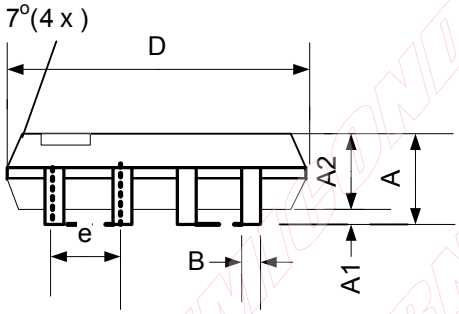
■ MARKING INFORMATION

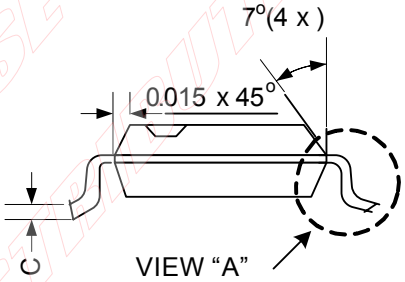


■ PACKAGE INFORMATION









Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.35	1.60	1.75	0.053	0.063	0.069
A1	0.05		0.15	0..002		0.006
A2	1.35	1.45	1.55	0.053	0.057	0.061
B	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.010
D	4.70	4.90	5.10	0.185	0.196	0.200
D1	3.202		3.402	0.126		0.134
E	3.80	3.90	4.00	0.148	0.154	0.160
E1	2.313		2.513	0.091		0.099
e	1.27TYP.			0.050TYP.		
H	5.80	5.99	6.30	0.228	0.236	0.248
L	0.38	0.71	1.27	0.015	0.028	0.050
θ	0°		8°	0°		8°

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