Mil-cots DC DC converters-HFL28 Series

1 FEATURES of Mil-cots DC DC converters-HFL28 Series

- **16 to 40 VDC input, typical 28V**
- **50W to 65W output power**
- **-55℃ to +125℃ operation**
- **Fully isolated**
- **100MΩ minimum (500V DC) isolation**
- **Inhibit and indefinite short circuit protection**
- **43W/in^3 power density**
- **Equivalent with Interpoint's MFL Series**
- **Hermetically sealed meatal cases**

Size: 76.33×38.23×10.16mm^3

Weight: 80 grams

Figure 1 HFL28 series DC/DC converters

2 DESCRIPTION of Mil-cots DC DC converters-HFL28 Series

The HFL28 Series of DC/DC converters offer up to 65 watts of output power with high reliability. The converters are packaged in hermetically sealed metal cases, making them ideal for use in aviation, aerospace and other high reliability applications.

The HFL28 series of converters use a pulse width modulated and single ended forward topology design. The operating principle is that the sampling signal of output voltage , coupled by the opto-coupler, works together with the sampling signal of input loop current to regulate the pulse width of the controller. The magnetic feedback technology can avoid magnetic saturation and improve products reliability effectively.

Thick film hybrid techniques provide the HFL 28 Series of converters with reliability levels and optimum miniaturazation.The design and manufacturing process of HFL28 Series of converters are in compliance with General Standards of Hybrid Integrated Circuits and detailed standards of manufacturing. Connected to a HFD-CE03 filter, the HFL28 Series of converters can achieve better electromagnetic compatibility(EMC) performance.

Table 1 Product models

MODELS	
SINGLE	**DUAL**
HFL28S5	**HFL28D5**
HFL28S12	**HFL28D12**
HFL28S15	**HFL28D15**
HFL28S28	

ABSOLUTE MAXIMUM RATINGS

- Input Voltage: 16 to 40 VDC
- Power Dissipation: 65 watts
- Lead Soldering Temperature:300℃(10s)
- Storage Temperature Range: -55℃ to +125℃
- Inhibit Voltage: 0.2V max
- External Synchronous Signals:
  - Frequency Range: 400k to 600kHz
  - Duty Ratio: 40% to 60%
  - Level: 0.8 V≤V≤5V

RECOMMENDED OPERATING CONDITIONS

- Input VDC: 16 to 40 V
- Case Temperature(Tc): -55 ℃ to

3 ELECTRICAL PERFORMANCE of Mil-cots DC DC converters-HFL28 Series

HFL28S5, HFL28S12

Table 2 Electrical Characteristics: (T_{CASE} = -55°C to +125°C, V_{IN} = 28V ± 0.5V, Full Load5, Unless Otherwise Specified)

Single output models			HFL28S5		HFL28S12	
Parameter	**Conditions**		**Min**	**Max**	**Min**	**Max**
Output Voltage(V)	*Io*=full load	Ambient temperature high and low temperature	4.950 4.875	5.050 5.125	11.88 11.76	12.12 12.24
Output Current(A)	V_{in} = 16 TO 40 VDC		—	10	—	5
Output Power(W)	—		—	50	—	60
Output Ripple Voltage (mV)	*BW*=10 kHz to 2 MHz I_o=full load	Ambient temperature high and low temperature	— —	35 50	— —	75 100
Line Regulation(mV)	V_{in} = 16 TO 40 VDC,*Io*=full load		—	20	—	20
Load Regulation(mV)	*Io*=No load to load		—	20	—	20
Input Ripple Current (mA)	*BW*=10 kHz to 10 MHz I_o=full load	Ambient temperature high and low temperature	— —	45 50	— —	45 50
Efficiency (%)	I_o=full load	Ambient temperature high and low temperature	77 75	— —	83 81	— —
Isolation (MΩ)	Input to output or any pin to case (except case ground pin) at 500 VDC, T_A = 25° C		100	—	100	—
Inhibit Function	T_A = 25° C，Inhibit voltage, output disabled		0	0.2	0	0.2
Protection Function	T_A = 25° C		5	—	5	—
Start-up Overshoot(mV pk)	V_{in}=0 to 28V, I_o=full load		—	25	—	50
Start-up Delay(ms)	V_{in}=0 to 28V, I_o=full load		—	6	—	6
Capacitive Load(μF)	T_A = 25° C, No effect on DC performance		—	1000	—	1000
Switching Frequency(kHz)	I_o=full load		400	600	400	600
Step Load Response Transient (mV pK)	50% load -- full load -50% load		-350	350	—	600
Step Load Response Recovery (μs)	50% load -- full load -50% load		—	3000	—	3000
Step Line Response Transient (mV pK)	V_{in}=16~40V, I_o=full load， V_{in}=40~16V, I_o=full load		—	300	—	400
Step Line Response Recovery (μs)	V_{in}=16~40V, I_o=full load， V_{in}=40~16V, I_o=full load		—	300	—	300
Load Fault recovery (ms)	I_O:short circuit to full load		—	4	—	4

Notes to Specifications:

① The step load transition time should be greater than or equal to 10μs.

② The step line transition time should be greater than or equal to 10μs.

③ Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of V_{OUT} at final value.

HFL28S15, HFL28S28

Table 3 Electrical Characteristics: (T_{CASE} = -55°C to +125°C, V_{IN} = 28V ± 0.5V, Full Load5, Unless Otherwise Specified)

Single output models			HFL28S15		HFL28S28	
Parameter	**Conditions**		**Min**	**Max**	**Min**	**Max**
Output Voltage (V)	*Io*=full load	Ambient temperature high and low temperature	14.85 14.55	15.15 15.45	27.72 27.16	28.28 28.84
Output Current(A)	V_{in} = 16 TO 40 VDC		—	4.33	—	2.32
Output Power(W)	—		—	**65**	—	**65**
Output Ripple Voltage(mV)	*BW*=10 kHz to 2 MHz I_o=full load	Ambient temperature high and low temperature	— —	85 110	— —	200 300
Line Regulation(mV)	V_{in} = 16 TO 40 VDC,*Io*=full load		—	20	—	120
Load Regulation(mV)	*Io*=No load to load		—	20	—	150
Input Ripple Current (mA)	*BW*=10 kHz to 10 MHz I_o=full load	Ambient temperature high and low temperature	— —	45 50	— —	50 60
Efficiency (%)	I_o=full load	Ambient temperature high and low temperature	84 82	— —	83 79	— —
Isolation (MΩ)	Input to output or any pin to case (except case ground pin) at 500 VDC, T_A = 25° C		100	—	100	—
Inhibit Function	T_A = 25° C，Inhibit voltage, output disabled		0	0.2	0	0.2
Protection Function	T_A = 25° C		5	—	5	—
Start-up Overshoot (mV pk)	V_{in}=0 to 28V, I_o=full load		—	50	—	100
Start-up Delay(ms)	V_{in}=0 to 28V, I_o=full load		—	6	—	6
Capacitive Load(μF)	T_A = 25° C, No effect on DC performance		—	1000	—	500
Switching Frequency(kHz)	I_o=full load		400	600	400	600
Step Load Response Transient (mV pK)	50% load -- full load -50% load		—	600	—	1400
Step Load Response Recovery (μs)	50% load -- full load -50% load		—	3000	—	3000
Step Line Response Transient (mV pK)	V_{in}=16~40V, I_o=full load， V_{in}=40~16V, I_o=full load		—	400	—	800
Step Line Response Recovery (μs)	V_{in}=16~40V, I_o=full load， V_{in}=40~16V, I_o=full load		—	300	—	400
Load Fault recovery (ms)	*Io*:short circuit to full load		—	4	—	4

Notes to Specifications:

① The step load transition time should be greater than or equal to 10μs.

② The step line transition time should be greater than or equal to 10μs.

③ Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of V_{OUT} at final value.

HFL28D5 HFL28D12 HFL28D15

Table 4 Electrical Characteristics: (T_{CASE} = -55°C to +125°C, V_{IN} = +28V ± 0.5V, Full Load5, Unless Otherwise Specified)

Dual output models			HFL28D5		HFL28D12		HFL28D15	
Parameter	Conditions		Min	Max	Min	Max	Min	Max
Output Voltage (V)	Io_1= Io_2= full load	Ambient temperature high and low temperature	4.95 4.85	5.05 5.15	11.88 11.64	12.12 12.36	14.85 14.55	15.15 15.45
		Ambient temperature high and low temperature	-5.08 -5.18	-4.92 -4.82	-12.18 -12.42	-11.82 -11.58	-15.23 -15.53	-14.77 -14.47
Output Current(A)	V_{IN} = 16 TO 40 VDC		—	5	—	2.5	—	2.17
Output Power(W)	-		—	50	—	60	—	65
Output Ripple Voltage(mV)	BW=10 kHz to 2 MHz Io_1= Io_2= full load	Ambient temperature high and low temperature	— —	50 100	— —	80 120	— —	100 150
		Ambient temperature high and low temperature	— —	50 100	— —	80 120	— —	100 150
Line Regulation (mV)	V_{IN} = 16 TO 40 VDC, Io_1= Io_2= full load	$+V_{out}$	—	50	—	50	—	50
		$-V_{out}$	—	100	—	100	—	100
Load Regulation (mV)	Io_1= Io_2=No load to full load	$+V_{out}$	—	50	—	50	—	50
		$-V_{out}$	—	100	—	120	—	150
Input Ripple Current(mA)	*BW*=10 kHz to 10 MHz Io_1= Io_2=full load	Ambient temperature high and low temperature	— —	45 50	— —	45 50	— —	45 50
Efficiency (%)	Io_1= Io_2=full load	Ambient temperature high and low temperature	77 75	— —	83 81	— —	84 82	— —
Isolation (MΩ)	Input to output or any pin to case (except case ground pin) at 500 VDC, T_A = 25° C		100	—	100	—	100	—
Inhibit Function	T_A = 25° C，Inhibit voltage, output disabled		0	0.2	0	0.2	0	0.2
Protection Function	T_A = 25° C		5	—	5	—	5	—
Start-up Overshoot (mV pk)	V_{in}=0 to 28V, Io_1=Io_2=full load		-25	25	-50	50	-50	50
Start-up delay (ms)	V_{in}=0 to 28V, Io_1=Io_2=full load		—	6	—	6	—	6
Capacitive Load(μF)	T_A = 25° C, No effect on DC performance		—	500	—	500	—	500
Switching Frequency(kHz)	Io_1=Io_2=full load		400	600	400	600	400	600
Step Load Response Transient(mV pK)	50% load to full load or full load to 50% load, Each V_{out} has balanced load		-350	350	-600	600	-600	600
Step Load Response Recovery (μs)	50% load to full load or full load to 50% load, Each V_{out} has balanced load		—	3000	—	3000	—	3000
Step Line Response Transient (mV pK)	V_{in}=16~40V, Io_1= Io_2=full load V_{in}=40~16V, Io_1= Io_2=full load		-300	300	-400	400	-400	400
Step Line Response Recovery (μs)	V_{in}=16~40V, Io_1=Io_2=full load V_{in}=40~16V, Io_1= Io_2=full load		—	300	—	300	—	300
Load Fault Short Circuit recovery (ms)	Io_1= Io_2 short circuit to full load		—	4	—	4	—	4

Notes to Specifications:

①The step load transition time should be greater than or equal to 10μs.

②The step line transition time should be greater than or equal to 10μs.

③Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of V_{OUT} at final value.

4 TYPICAL PERFORMANCE CURVES of Mil-cots DC DC converters-HFL28 Series

(1) Single output model （HFL28S15F）

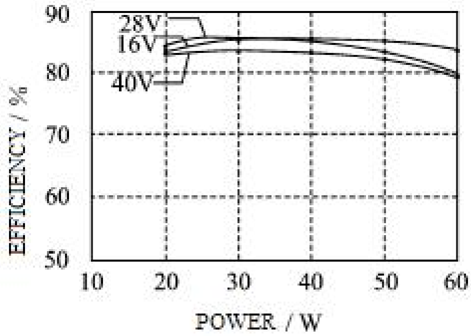


Figure 2 Efficiency (OUTPUT POWER)

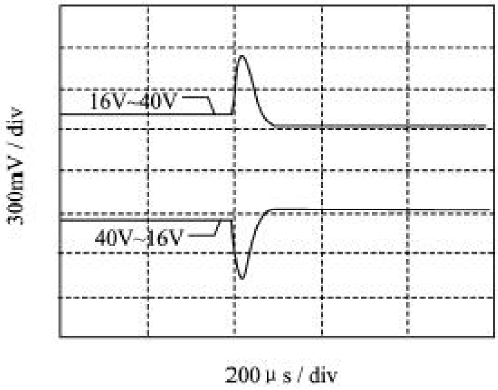


Figure 3 STEP LINE RESPONSE

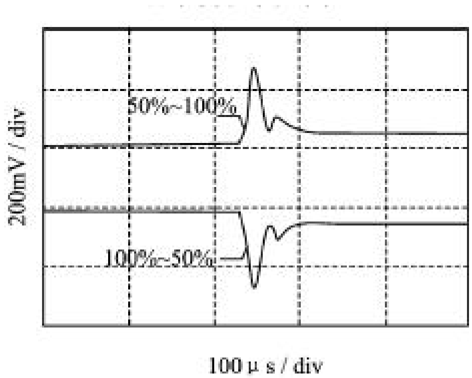


Figure 4 STEP LOAD RESPONSE

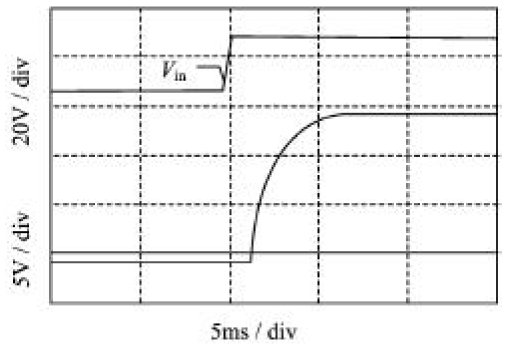


Figure 5 START-UP OVERSHOOT/ DELAY

(2) Dual output model （HFL28D15）

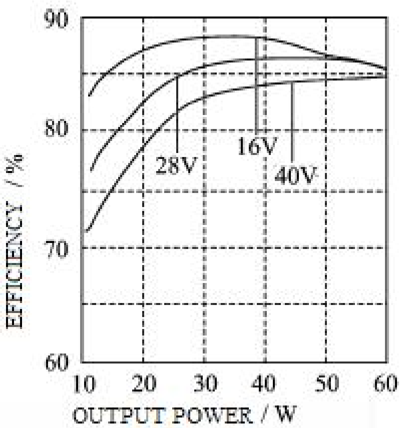


Figure 6 EFFICIENCY(OUTPUT POWER)

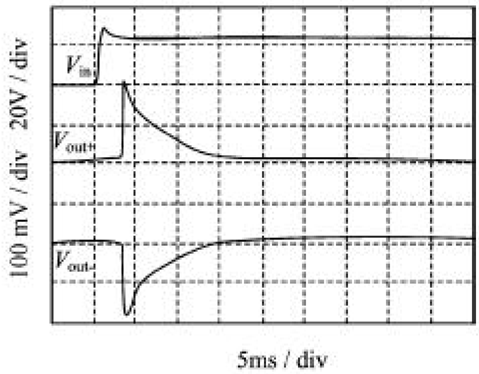


Figure 7 STEP LINE RESPONSE

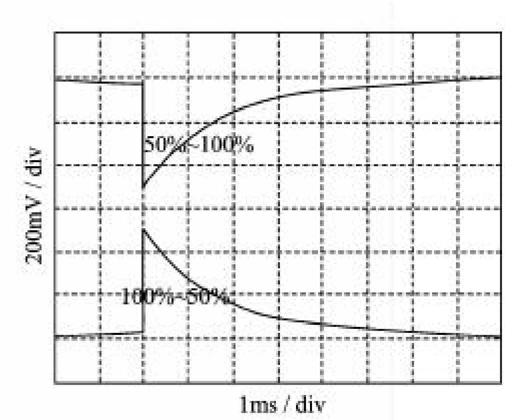


Figure 8 STEP LOAD RESPONSE

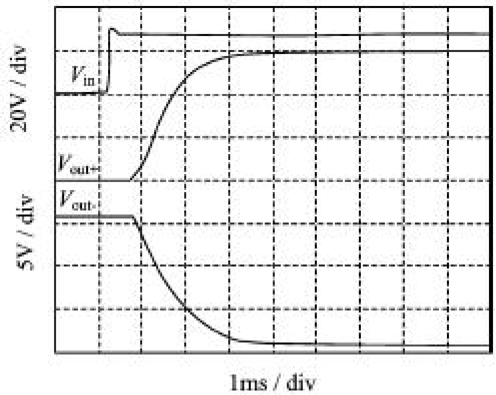


Figure 9 START-UP OVERSHOOT/DELAY

5 TYPICAL MTBF CURVES of Mil-cots DC DC converters-HFL28 Series

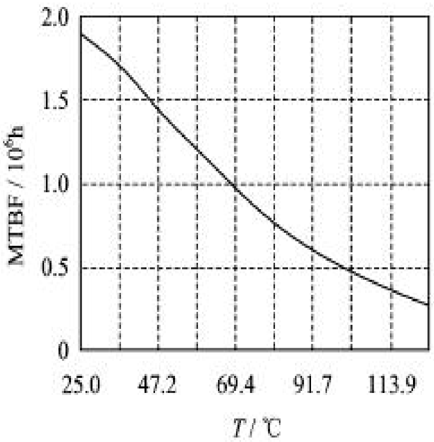


Figure10 Model HFL28S15

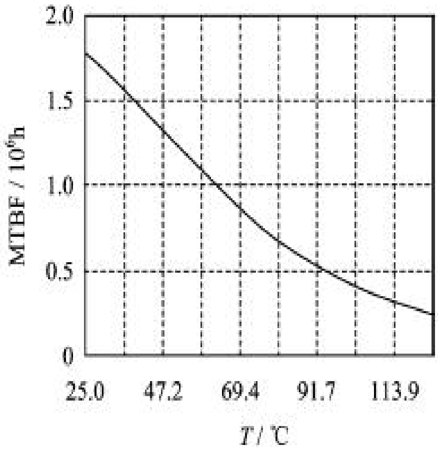
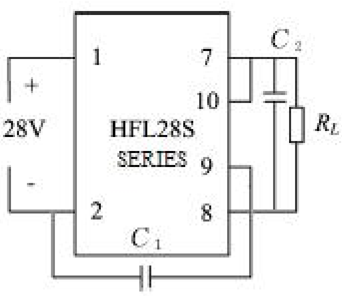


Figure 11 Model HFL28D15

6 TYPICAL CONNECTION DIAGRAM of Mil-cots DC DC converters-HFL28 Series



C_1 100pF/500V~0.1μF/500V

C_2 0.01μF/50V~100μF/50V

Figure12 Application Connection Diagram For Single Output Models

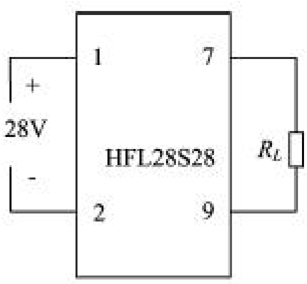


Figure13 Application Connection Diagram ForModel HFL28S28

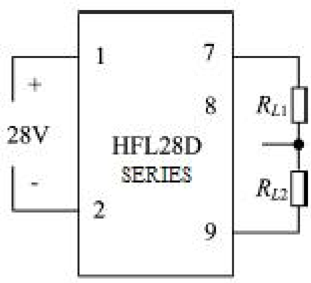


Figure14 Application Connection Diagram For Dual Output Models

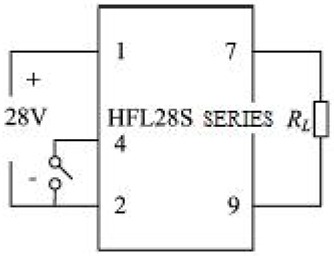


Figure 15 Inhibit Drive Connection Diagram for Single Output Models

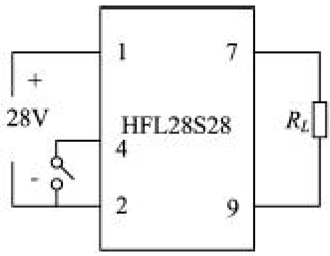


Figure 16 Inhibit Drive Connection Diagram for Model HFL28S28

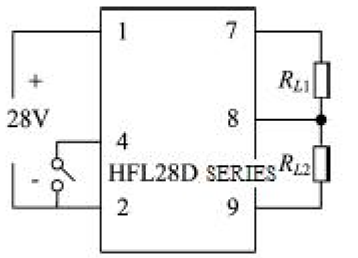


Figure 17 Inhibit Drive Connection Diagram for Dual Output Models

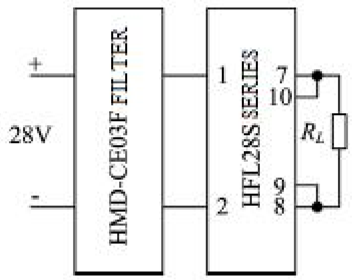


Figure 18 Connection Diagram for Single Output Converter with EMI Filter

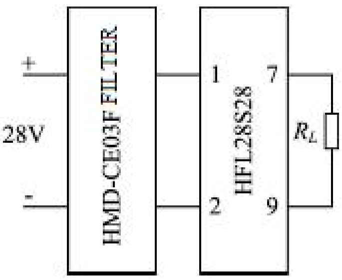


Figure 19 Connection Diagram for Model HFL28S28 Converter with EMI Filter

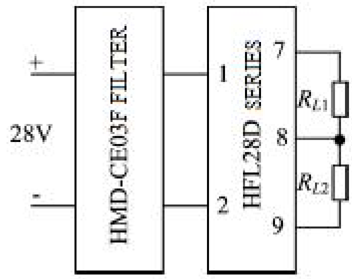


Figure 20 Connection Diagram for Dual Output Converter with EMI Filter

7 PACKAGE SPECIFICATIONS of Mil-cots DC DC converters-HFL28 Series

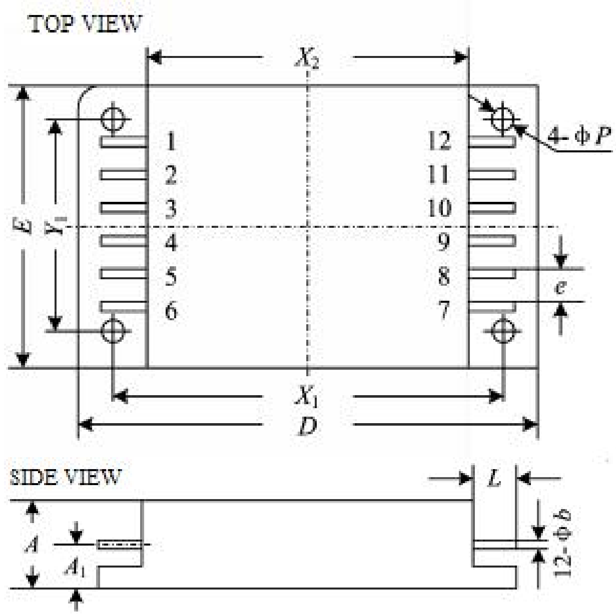


Figure21 Package Outline

Units:mm			
Dimension Symbols	Min.	Typ.	Max.
A	—	—	10.16
A_1	5.39	—	5.79
φb	0.89	—	1.14
D	75.95	—	76.45
e	—	5.08	—
E	37.97	—	38.23
L	5.58	—	6.10
φP	3.12	—	3.38
X_1	69.85	—	70.36
X_2	63.37	—	63.63
Y_1	31.88	—	32.13

Table 5 Case Materials

Case Model	Header	Header Plating	Cover	Cover Plating	Pin	Pin Plating	Sealing Style	Notes
FPP6438-12	Cold Rolled Steel	Nickel	Iron/Nickel Alloy(4J42)	Nickel	Copper Compound	Nickel/Gold	Compression Seal	

Notes: Solder pins individually with heat application not exceeding 300° C for 10 seconds per pin.

8 PIN DESIGNATION of Mil-cots DC DC converters-HFL28 Series

Figue 22 Bottom View of Pin Out

Table 6 Pin Designation

Pin	Single Output	Dual Output
1	Positive Input	Positive Input
2	Input Common	Input Common
3	NC	NC
4	Inhibit 1	Inhibit 1
5	NC	NC
6	Synchronous Input	Synchronous Input
7	Output	Positive Output
8	Output Common	Output Common
9	Negative Output Sense	Negative Output
10	Positive Output Sense	NC
11	NC	NC
12	Inhibit 2	Inhibit 2

9 ORDERING INFORMATION of Mil-cots DC DC converters-HFL28 Series

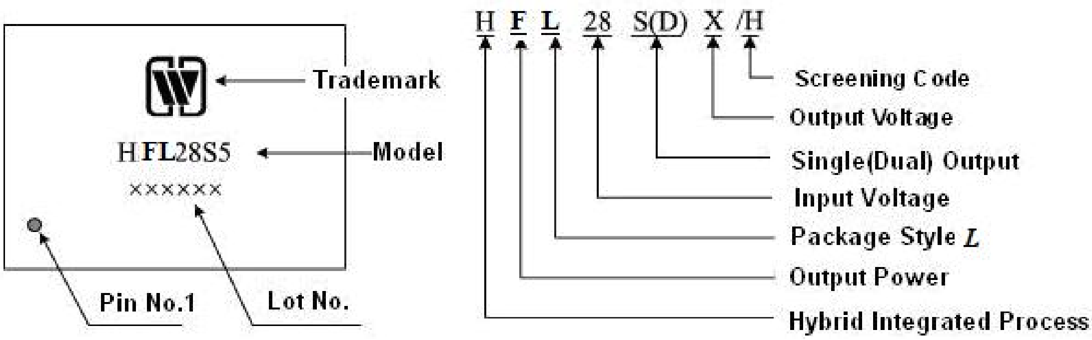


Figure23 Part Numbering Key

Application Notes:

- ➢ The correct power supply is to be ensured that may not cause permanent damage to the device.
- ➢ When the electrical performance is tested, the testing position should be pin of the device.
- ➢ When the device is mounted, the bottom of the device should be closely attached to the circuit board. So as to avoid the damage of the pins, the shockproof should be increased when it is required
- ➢ The pin should not be bending to avoid the glass insulator breaking and case leakage.
- ➢ When the case temperature is at 105℃, it is suggested that thickness of the thermal sinking plate(copper material) is 5mm, the dimension is greater than 120mm×100mm.
- ➢ When the case temperature is at 125℃, it is suggested that thickness of the thermal sinking plate is 5mm, the dimension is greater than 120mm×80mm.

To request a quotation or place orders ,please contact our sales representative or the ECRIM SalesDepartment at:

Sales Phone: (086) 0551-3667943 **Sales Fax**: (086) 0551-3638101

E-mail: sales@ecrim.cn