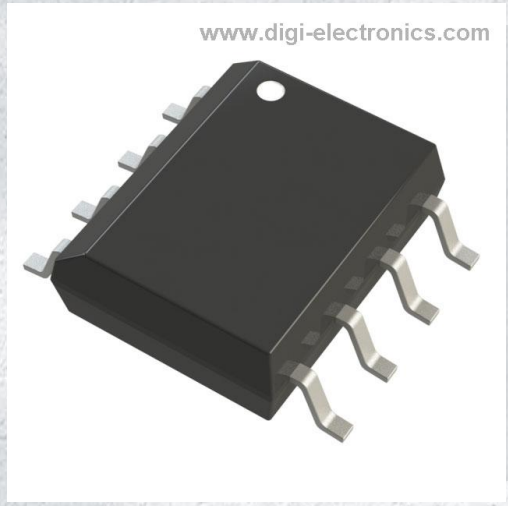
AP3171MPTR-G1 Datasheet



https://www.DiGi-Electronics.com

DiGi Electronics Part Number	AP3171MPTR-G1-DG
Manufacturer	Diodes Incorporated
Manufacturer Product Number	AP3171MPTR-G1
Description	IC REG BUCK ADJ 1.5A/2A 8SO
Detailed Description	Buck Switching Regulator IC Positive Adjustable 5V , 9V, 12V 1 Output 1.5A, 2A 8-SOIC (0.154", 3.90mm Width) Exposed Pad

Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
AP3171MPTR-G1	Diodes Incorporated
Series:	Product Status:
-	Obsolete
Function:	Output Configuration:
Step-Down	Positive
Topology:	Output Type:
Buck	Adjustable
Number of Outputs:	Voltage - Input (Min):
1	10V
Voltage - Input (Max):	Voltage - Output (Min/Fixed):
40V	5V, 9V, 12V
Voltage - Output (Max):	Current - Output:
-	1.5A, 2A
Frequency - Switching:	Synchronous Rectifier:
120kHz	Yes
Operating Temperature:	Mounting Type:
-40°C ~ 85°C (TA)	Surface Mount
Package / Case:	Supplier Device Package:
8-SOIC (0.154", 3.90mm Width) Exposed Pad	8-SO-EP
Base Product Number:	
AP3171	

Environmental & Export classification

RoHS Status:	Moisture Sensitivity Level (MSL):
ROHS3 Compliant	3 (168 Hours)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	
8542.39.0001	

Lead-free Green

AP3171

QUICK CHARGE BUCK CONVERTER COMPATIBLE TO QUALCOMM QC 2.0

Description

The AP3171 is a constant voltage (CV), constant current (CC) and synchronous rectification buck converter compatible with Qualcomm Quick Charge 2.0.

The AP3171 combines PWM controller, high/low side power MOSFETs, CC/CV control and Qualcomm QC 2.0 decoder in one package so as to achieve high performance with compact profile. According to different D+/D- signal combinations, the AP3171 will set the output voltage and full current capabilities to 5V/2A, 9V/2A or 12V/1.5A respectively. The AP3171 automatically provides 5V/2A output configuration to backwards compatible to the existing devices that are not compatible to Qualcomm QC 2.0.

The AP3171 has a fixed switching frequency of 120kHz at heavy load. At light load and no load, its zero current detection (ZCD) function takes effect to have the system enter into discontinuous current mode (DCM) to improve power conversion efficiency.

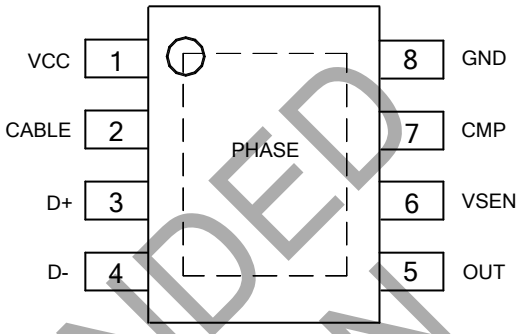
The AP3171 has versatile protection functions to guarantee a safe operation, including input voltage under voltage lock-out (UVLO), output voltage over voltage protection (OVP) and under voltage protection (UVP), inductor peak current limit and Internal over temperature protection (OTP).

Furthermore, the AP3171 has cable compensation and it is adjustable by the external resistor.

The AP3171 is available in the SO-8EP package.

Pin Assignments

(Top View)



Note: The PHASE pin of BUCK converter is exposed PAD, which is at bottom of the IC (the dashed box).

SO-8EP

Features

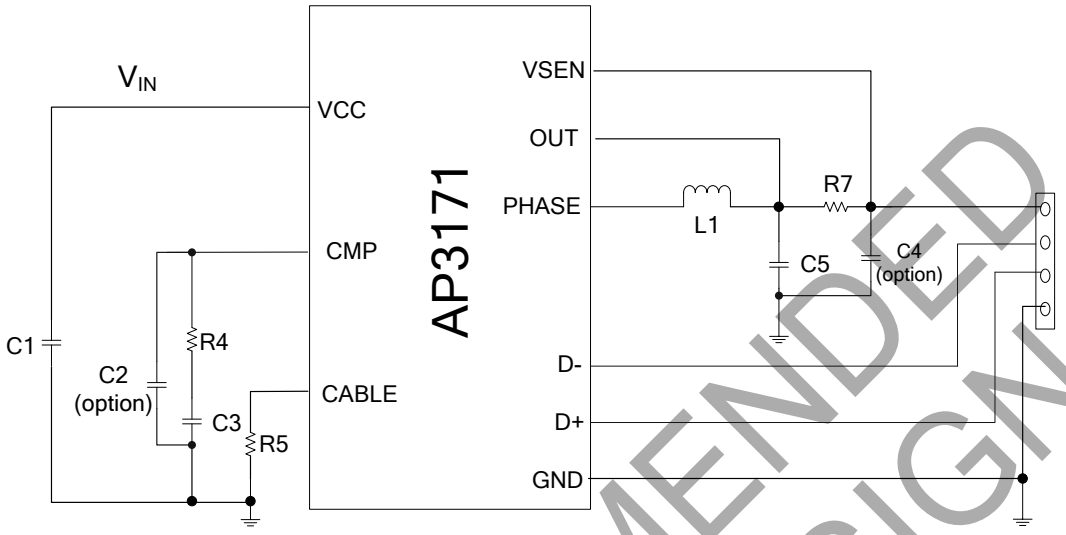
- 8.7V to 40V Input Voltage Range
- Fixed 120k Operating Frequency
- Integrated Two MOSFETs for Synchronization Rectification
- Quick Charge Function Compatible with Qualcomm QC 2.0 Protocol
- Input Protection – UVLO
- Output Protection – UVP/OVP
- OCP Function
- Adjustable Cable Compensation
- Output CC/CV Mode Function
- Reference Accuracy :
  CV ±1.5% CC ±4% (5V)
  CV ±2.5% CC ±5% (9V/12V)
- Output power: 5V/10W, 9V/18W, 12V/18W
- Internal OTP Function
- **Totally Lead-free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen- and Antimony-Free. "Green" Device (Note 3)**

Applications

- Car Charger
- Automotive Power application
- General DC/DC Application Need CC/CV Mode

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

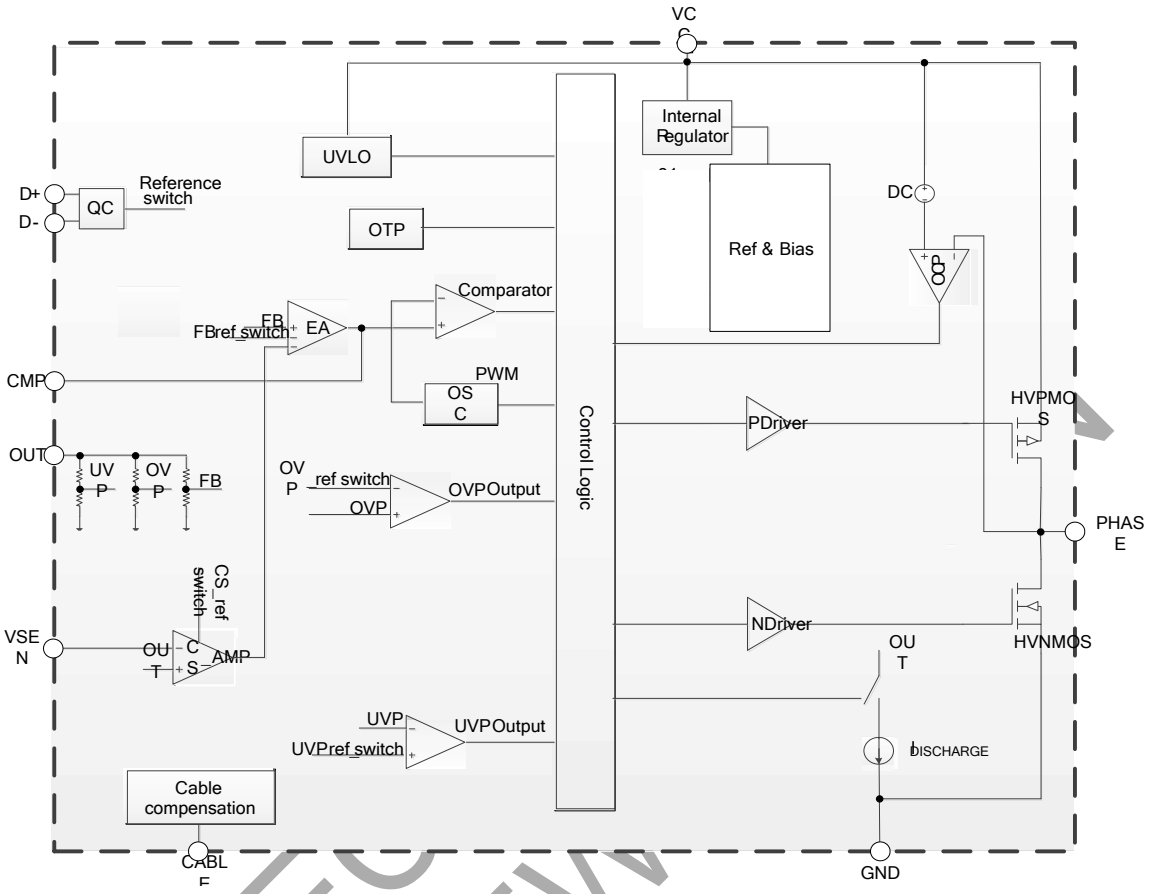
Typical Applications Circuit



Pin Descriptions

Pin Number	Pin Name	Function
1	VCC	IC voltage supplier and input voltage for power conversion; Decoupling cap is required to be placed to this pin and GND pin as close as possible
2	CABLE	Connected to the external resistor to set the cable compensation value
3	D+	Connected to USB D+
4	D-	Connected to USB D-
5	OUT	Sense the output voltage; connected to the input of current sense resistor
6	VSEN	Sense the output current; connected to the output of current sense resistor
7	CMP	The EA output pin to compensate the loop
8	GND	Ground return for the power stage and controller
Exposed PAD	PHASE	Connected to the input of external output inductor

Functional Block Diagram



Absolute Maximum Ratings (Note 4)

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{CC}	-0.3 to 42	V
Voltage From PHASE to GND	V_{PHASE}	-0.3 to 42	V
Voltage From OUT to GND	V_{OUT}	-0.3 to 20	V
Voltage on Other Separate Pins	–	-0.3 to 6	V
Thermal Resistance (Note 5)	θ_{JA}	63	°C/W
Operating Junction Temperature	T_J	-40 to +125	°C
Storage Temperature	T_{STG}	-65 to +150	°C
ESD (Human Body Model)	–	2000	V
ESD (Machine Model)	–	200	V

Note: 4. Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.
5. Device mounted on FR-4 substrate PC board, 2oz copper, with 1 square inch pad layout.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	10	40	V
T_A	Ambient Temperature	-40	+85	°C

Electrical Characteristics (@ T_A = +25°C, V_{CC} = 16V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply Voltage						
V_{ST}	Startup Voltage	–	8.4	8.7	9.0	V
–	UVLO	–	6.75	7.00	7.25	V
$I_{NO-LOAD}$	I_{CC} @ No-load Condition	–	–	2	–	mA
CV/CC Control						
V_{REF_12V}	Voltage Control Loop Reference	–	11.7	12.0	12.3	V
V_{REF_9V}		–	8.77	9.00	9.23	V
V_{REF_5V}		–	4.92	5.00	5.08	V
V_{CABLE}	Cable Compensation	R_{CABLE}=17.6k, R_{SENSE} = 27.27mΩ	–	400	–	mV
V_{CS_12V}	Current Control Loop Reference	–	41.0	45.0	49.0	mV
V_{CS_9V}		–	57.0	60.0	63.0	mV
V_{CS_5V}		–	57.6	60.0	62.4	mV
Internal MOSFET						
$R_{DS(ON)\_UP}$	High Side MOSFET $R_{DS(ON)}$	–	–	100	–	mΩ
$R_{DS(ON)\_LOW}$	Low Side MOSFET $R_{DS(ON)}$	–	–	45	–	mΩ
PWM And Oscillation						
f_S	Switching Frequency	–	–	120	–	kHz
D_{MAX}	Maximum Duty	–	–	95	–	%
I_{DIS}	Discharge Current@ OUT Pin	–	–	100	–	mA
Protection						
V_{OVP_5V}	Output OVP Threshold @5V	Note 6	5.63	5.80	5.97	V
V_{OVP_9V}	Output OVP Threshold @9V		10.13	10.44	10.75	V
V_{OVP_12V}	Output OVP Threshold @12V		13.51	13.92	14.33	V
V_{UVP_5V}	Output UVP Threshold @5V	–	3.13	3.30	3.47	V
V_{UVP_9V}	Output UVP Threshold @9V	–	5.63	5.94	6.24	V
V_{UVP_12V}	Output UVP Threshold @12V	–	7.51	7.92	8.33	V
I_{PK_MAX}	MOSFET Maximum I_{PEAK} Limitation	–	–	4.0	–	A
Internal OTP						
–	Internal OTP Trigger Temperature	–	–	+160	–	°C
–	Internal OTP Recovery Temperature	–	–	+140	–	°C
QC 2.0 protocol definition						
V_{DAT_REF}	Data Detect Voltage	–	0.25	0.325	0.40	V
V_{SEL_REF}	VSEL_REF (Reference for Selecting HVDCP Voltage)	–	1.8	2	2.2	V
$t_{GLITCH\_BC\_DONE}$	D+ High Glitch Filter Time	–	1	1.25	1.5	s
$t_{GLITCH\_DM\_LOW}$	D- Low Glitch Filter Time	Note 7	1	2.5	–	ms

Notes: 6. The value in table is only for I_O=0A. If I_O is not zero，the over voltage protection value needs to add cable compensation voltage.
7. Guaranteed by design.

Operation Description

Qualcomm QC 2.0 Protocol Operation

Decoder	V_{D+} (V)	V_{D-} (V)	Charger Output Voltage/Full Current Capability
Qualcomm Quick Charge 2.0 Protocol Class A: 5V, 9V, 12V	0.6	0.6	12V/1.5A
	3.3	0.6	9V/2A
	0.6	3.3	Keep Present V1/V2 Status Unchanged
	3.3	3.3	Keep Present V1/V2 Status Unchanged
	0.6 or 3.3	GND	5V/2A
	GND	0.6 or 3.3 or GND	5V/2A (Protocol Handshake Reset)

Constant Current Operation

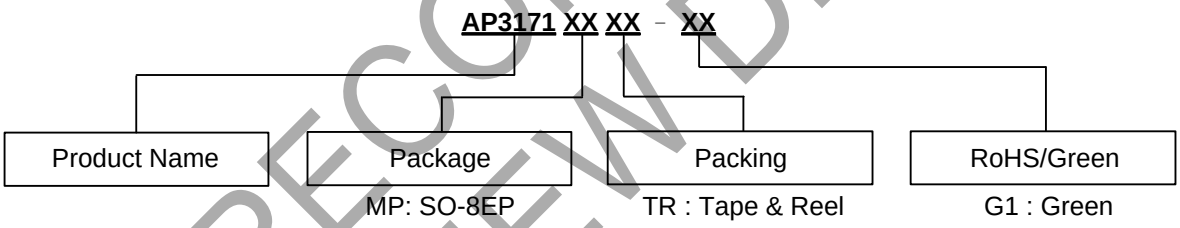
The AP3171 can work in constant-current (CC) mode. The output current is sensed by a current sense resistor R_{SENSE}. As output current increases, the voltage drop across R_{SENSE} will be limited to a reference voltage (V_{CS}) to accomplish CC function. The default R_{SENSE} is 27.27mΩ to get the typical CC point of 110% full output current.

Cable Compensation

The cable compensation can be calculated as below:

$V_{CABLE}=I_O * R_{SENSE} * 129.5k/R_{CABLE}$

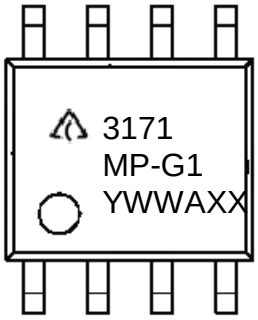
Ordering Information



Package	Part Number	Marking ID	Packing
SO-8EP	AP3171MPTR-G1	3171MP-G1	4,000/Tape & Reel

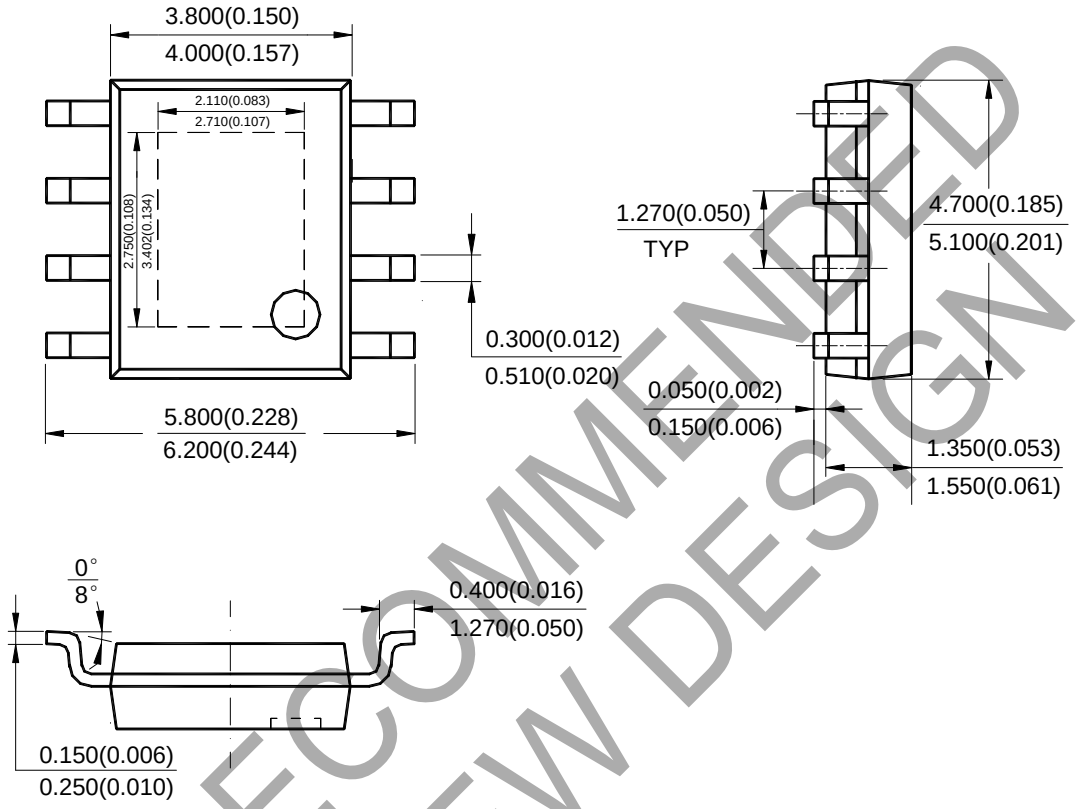
Marking Information

(Top View)



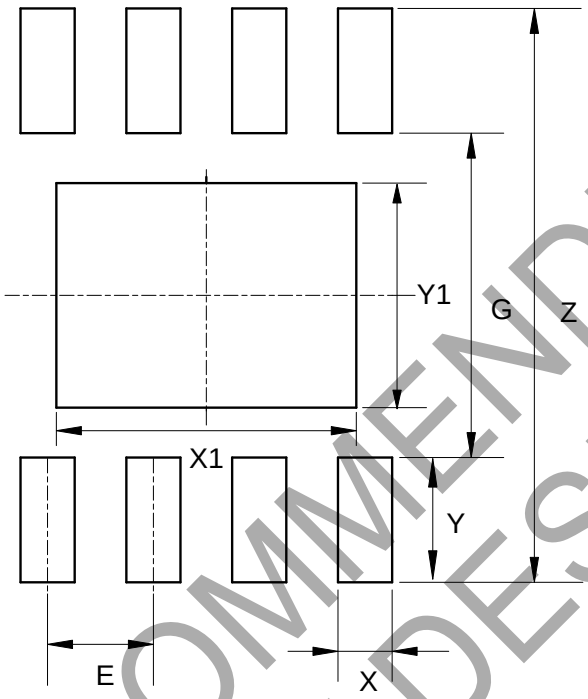
First and Second Lines: Logo and Marking ID
Third Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: 7th and 8th Digits of Batch No.

Package Outline Dimensions (All dimensions in mm(inch).)



Note: Eject hole, oriented hole and mold mark is optional.

Suggested Pad Layout



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	X1 (mm)/(inch)	Y1 (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	3.600/0.142	2.700/0.106	1.270/0.050

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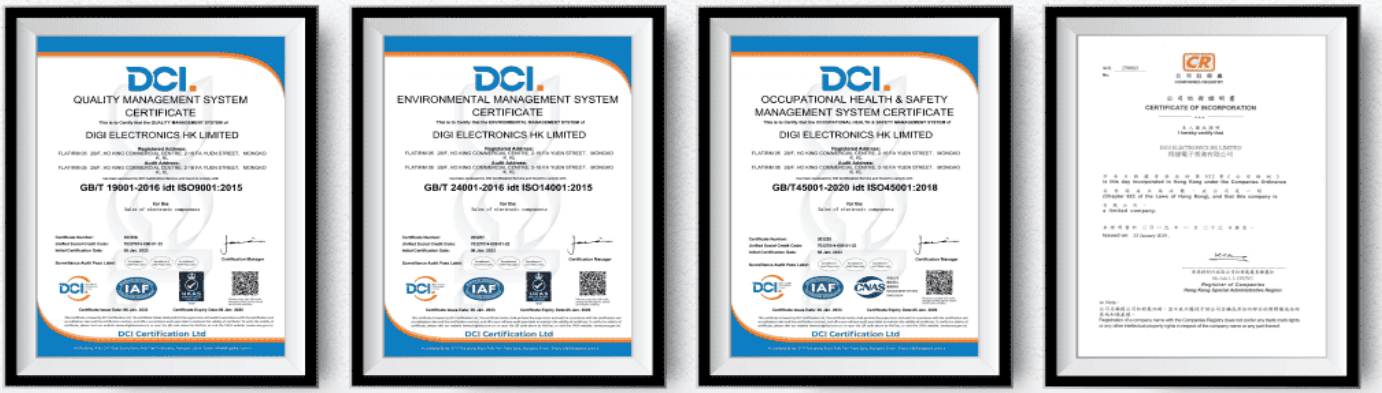

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