Design Idea DI-88
DPA-Switch® PoE Detection and Classification (Class 0-3) Interface Circuit

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
PoE/VoIP	DPA423G	6.49 W	36-57 VDC	3.3 V	Flyback

Design Highlights

- Simple interface for Power Over Ethernet (PoE) Powered Devices (PDs)
- Includes PoE detection and classification circuits for all classes (0, 1, 2 and 3)
- Compliance to IEEE802.3af PoE standards verified by University of New Hampshire Interopability Consortium (UNH-IOC)*
- Includes under voltage lockout (42 VDC on, 34 VDC off)

PoE Detection and Classification

PoE is becoming widely adopted for networking and VoIP telecom applications. A typical PD solution is shown in Figure 1 and has a PoE interface circuit and a *DPA-Switch* DC-DC converter block **(see EPR-68 for full details of operation of the DC-DC converter)**.

The PoE specification requires the PD to implement three functions: detection, classification and pass-switch connection.

Detection occurs as the input voltages rises from 2.5 to 10 VDC. Resistor R31 within the PD presents the detection impedance to the PSE.

Classification occurs as the input voltages rises from 14.5 to 20.5 VDC. The sending device determines the class of the PD by monitoring the amount of current drawn by the PD during this phase. For classes 1, 2 and 3, the classification current (I_{CL}), is programmed by resistor R34, as per the table.

Class	P_{OUT} (min)	P_{OUT} (max)	I_{CL} (min)	I_{CL} (max)	R34
	W	W	mA	mA	Ohms
0	0.44	12.95	0.5	4	-
1	0.44	3.84	9	12	133
2	3.84	6.49	17	20	69.8
3	6.49	12.95	26	30	45.3

Components R32, R33, R34, R35, Q31, Q32, Q33, Q34, VR31 and U31 are not installed for Class 0 applications, and the classification current is programmed by R31 (24.9 k).

Operation

Resistor R31 provides the detection impedance. In order to allow correct operation over the detection voltage range, Zener diode

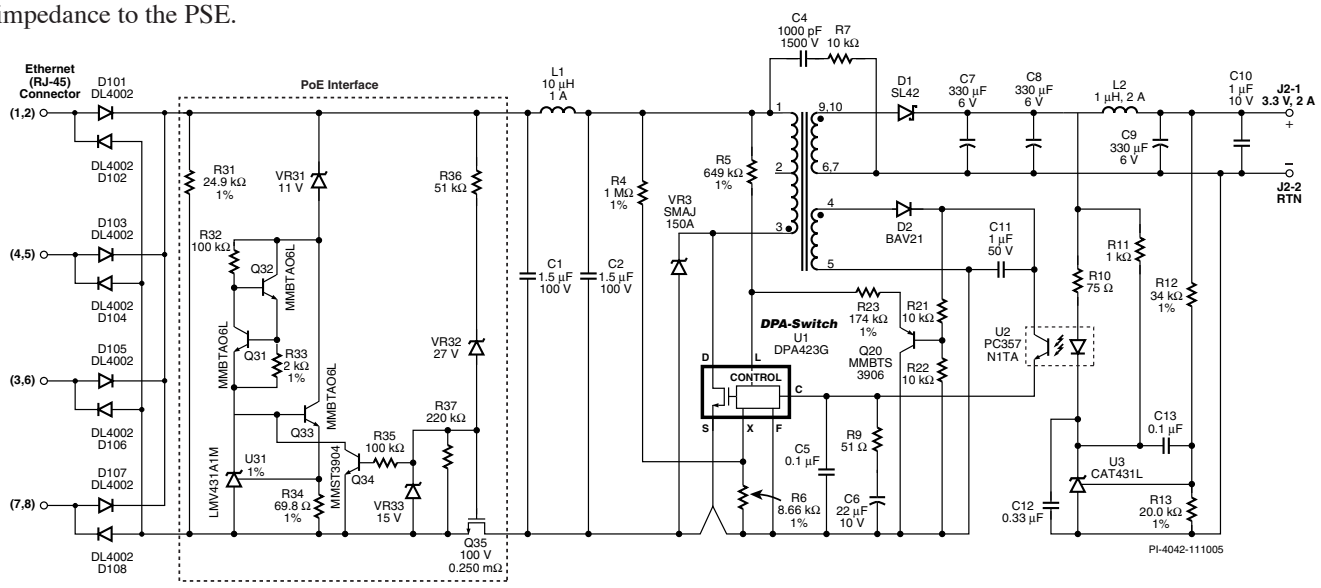

Figure 1. PoE Interface Circuit – Class 2.

*UNH-IOC test reports are available on the PI website www.powerint.com/poe

VR31 inhibits the classification circuit at input voltages below 11 V. Components Q32, Q31 and R32 form a 350 µA bias current source programmed by resistor R33 working in conjunction with the base-emitter voltage of Q31. Transistor Q33 forms the classification current source programmed by resistor R34 working in conjunction with the 1.24 V voltage reference U31. Transistor Q34 disables the classification current source when Zener diode VR32 conducts (when the input voltage exceeds approximately 28 V).

Key Design Points

- For Class 0, remove components VR31, R32, R33, R34, R35, Q31, Q32, Q33, Q34 and U31.
- R34 values: Class 1, R34 = 133 Ω; Class 2, R34 = 68.9 Ω; Class 3, R34 = 45.3 Ω.
- It is possible to use either bipolar transistor or MOSFET pass-switches (Q35). A bipolar transistor is less expensive, but a MOSFET gives higher pass-switch efficiency. See design idea (DI-70) for details.
- The bias current source (Q31) is used to allow the classification current source to be turned-off for minimal power loss once input voltage exceeds 28 VDC. This limits the dissipation of the classification circuit to approximately 20 mW at high input line (57 VDC) plus detection resistor (R31) dissipation of 130 mW.

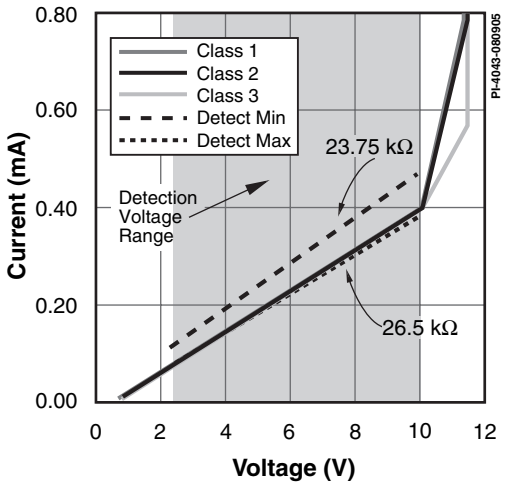

Figure 2. Detection Impedance V-I Curve.

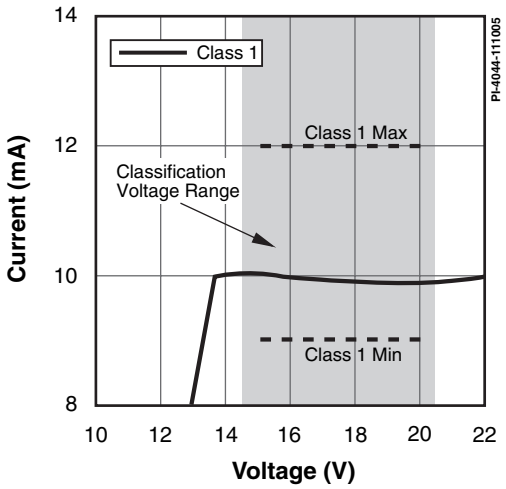

Figure 3. Classification Current (Class 1: R34 = 133 Ω).

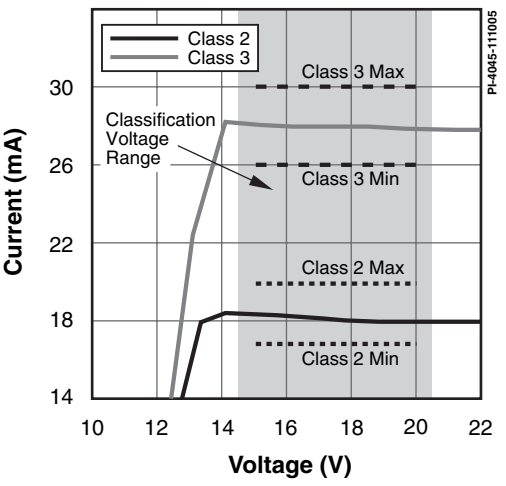

Figure 4. Classification Current (Classes 2 & 3: R34 = 69.8 Ω and R34 = 45.3 Ω).

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