

Features

- I_{off} supports partial-power-down mode operation
- Edge-rate control circuitry for significantly improved noise characteristics
- Typical output skew < 250 ps
- ESD > 2000V
- TSSOP (19.6-mil pitch) and SSOP (25-mil pitch) packages
- Industrial temperature range of -40°C to $+85^{\circ}\text{C}$
- $V_{CC} = 5\text{V} \pm 10\%$

CY74FCT16373T Features:

- 64 mA sink current, 32 mA source current
- Typical V_{OLP} (ground bounce) < 1.0V at $V_{CC} = 5\text{V}$, $T_A = 25^{\circ}\text{C}$

CY74FCT162373T Features:

- Balanced 24 mA output drivers
- Reduced system switching noise
- Typical V_{OLP} (ground bounce) < 0.6V at $V_{CC} = 5\text{V}$, $T_A = 25^{\circ}\text{C}$

Functional Description

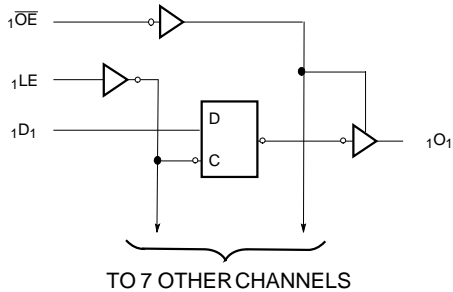
CY74FCT16373T and CY74FCT162373T are 16-bit D-type latches designed for use in bus applications requiring high speed and low power. These devices can be used as two independent 8-bit latches or as a single 16-bit latch by connecting the Output Enable (\overline{OE}) and Latch (LE) inputs. Flow-through pinout and small shrink packaging aid in simplifying board layout.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

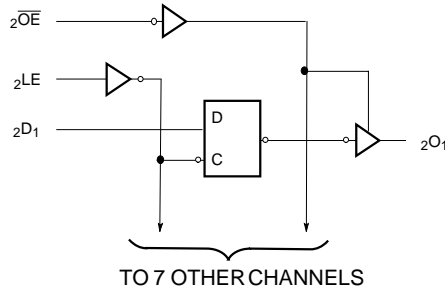
The CY74FCT16373T is ideally suited for driving high-capacitance loads and low-impedance backplanes.

The CY74FCT162373T has 24-mA balanced output drivers with current limiting resistors in the outputs. This reduces the need for external terminating resistors and provides for minimal undershoot and reduced ground bounce. The CY74FCT162373T is ideal for driving transmission lines.

Logic Block Diagrams



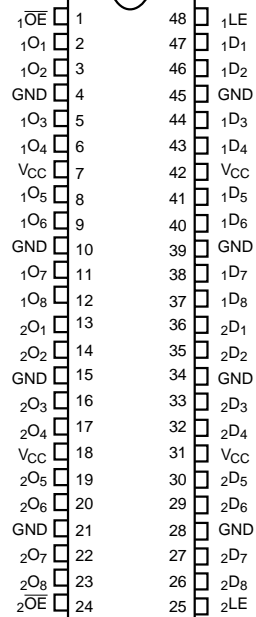
FCT162373-1



FCT162373-2

Pin Configuration

SSOP/TSSOP/TVSOP Top View



FCT162373-3

Pin Description

Name	Description
D	Data Inputs
LE	Latch Enable Inputs (Active HIGH)
\overline{OE}	Output Enable Inputs (Active LOW)
O	Three-State Outputs

Function Table^[1]

Inputs			Outputs
D	LE	\overline{OE}	O
H	H	L	H
L	H	L	L
X	L	L	Q ₀
X	X	H	Z

Maximum Ratings^[2, 3]

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature..... Com'l -55°C to +125°C

Ambient Temperature with Power Applied..... Com'l -55°C to +125°C

DC Input Voltage -0.5V to +7.0V

DC Output Voltage -0.5V to +7.0V

DC Output Current (Maximum Sink Current/Pin) -60 to +120 mA

Power Dissipation 1.0W

Static Discharge Voltage..... >2001V (per MIL-STD-883, Method 3015)

Operating Range

Range	Ambient Temperature	V _{CC}
Industrial	-40°C to +85°C	5V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	Min.	Typ. ^[4]	Max.	Unit
V _{IH}	Input HIGH Voltage		2.0			V
V _{IL}	Input LOW Voltage				0.8	V
V _H	Input Hysteresis ^[5]			100		mV
V _{IK}	Input Clamp Diode Voltage	V _{CC} =Min., I _{IN} =-18 mA		-0.7	-1.2	V
I _{IH}	Input HIGH Current	V _{CC} =Max., V _I =V _{CC}			±1	μA
I _{IL}	Input LOW Current	V _{CC} =Max., V _I =GND			±1	μA
I _{OZH}	High Impedance Output Current (Three-State Output pins)	V _{CC} =Max., V _{OUT} =2.7V			±1	μA
I _{OZL}	High Impedance Output Current (Three-State Output pins)	V _{CC} =Max., V _{OUT} =0.5V			±1	μA
I _{OS}	Short Circuit Current ^[6]	V _{CC} =Max., V _{OUT} =GND	-80	-140	-200	mA
I _O	Output Drive Current ^[6]	V _{CC} =Max., V _{OUT} =2.5V	-50		-180	mA
I _{OFF}	Power-Off Disable	V _{CC} =0V, V _{OUT} ≤4.5V ^[7]			±1	μA

Output Drive Characteristics for CY74FCT16373T

Parameter	Description	Test Conditions	Min.	Typ. ^[4]	Max.	Unit
V _{OH}	Output HIGH Voltage	V _{CC} =Min., I _{OH} =-3 mA	2.5	3.5		V
		V _{CC} =Min., I _{OH} =-15 mA	2.4	3.5		V
		V _{CC} =Min., I _{OH} =-32 mA	2.0	3.0		V
V _{OL}	Output LOW Voltage	V _{CC} =Min., I _{OL} =64 mA		0.2	0.55	V

Notes:

- H = HIGH Voltage Level. L = LOW Voltage Level. X = Don't Care. Z = High Impedance. Q₀=Previous state of flip-flop.
- Operation beyond the limits set forth may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.
- Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
- Typical values are at V_{CC}=5.0V, T_A= +25°C ambient.
- This parameter is specified but not tested.
- Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample and hold techniques are preferable in order to minimize internal chip heating and more accurately reflect operational values. Otherwise prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parametric tests. In any sequence of parameter tests, I_{OS} tests should be performed last.
- Tested at +25°C.

Output Drive Characteristics for CY74FCT162373T

Parameter	Description	Test Conditions	Min.	Typ. ^[4]	Max.	Unit
I _{ODL}	Output LOW Current ^[6]	V _{CC} =5V, V _{IN} =V _{IH} or V _{IL} , V _{OUT} =1.5V	60	115	150	mA
I _{ODH}	Output HIGH Current ^[6]	V _{CC} =5V, V _{IN} =V _{IH} or V _{IL} , V _{OUT} =1.5V	-60	-115	-150	mA
V _{OH}	Output HIGH Voltage	V _{CC} =Min., I _{OH} =-24 mA	2.4	3.3		V
V _{OL}	Output LOW Voltage	V _{CC} =Min., I _{OL} =24 mA		0.3	0.55	V

Capacitance^[5] (T_A = +25°C, f = 1.0 MHz)

Parameter	Description	Test Conditions	Typ. ^[4]	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	4.5	6.0	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	5.5	8.0	pF

Power Supply Characteristics

Parameter	Description	Test Conditions	Typ. ^[4]	Max.	Unit
I _{CC}	Quiescent Power Supply Current	V _{CC} =Max. V _{IN} ≤0.2V, V _{IN} ≥V _{CC} -0.2V	5	500	μA
ΔI _{CC}	Quiescent Power Supply Current (TTL inputs HIGH)	V _{CC} =Max. V _{IN} =3.4V ^[8]	0.5	1.5	mA
I _{CCD}	Dynamic Power Supply Current ^[9]	V _{CC} =Max., One Input Toggling, 50% Duty Cycle, Outputs Open, OE=GND V _{IN} =V _{CC} or V _{IN} =GND	60	100	μA/MHz
I _C	Total Power Supply Current ^[10]	V _{CC} =Max., f ₁ =10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling, OE=GND, LE=V _{CC} V _{IN} =V _{CC} or V _{IN} =GND	0.6	1.5	mA
		V _{CC} =Max., f ₁ =10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling, OE=GND, LE=V _{CC} V _{IN} =3.4V or V _{IN} =GND	0.9	2.3	mA
		V _{CC} =Max., f ₁ =2.5 MHz, 50% Duty Cycle, Outputs Open, Sixteen Bits Toggling, OE=GND, LE=V _{CC} V _{IN} =V _{CC} or V _{IN} =GND	2.4	4.5 ^[11]	mA
		V _{CC} =Max., f ₁ =2.5 MHz, 50% Duty Cycle, Outputs Open, Sixteen Bits Toggling, OE=GND, LE=V _{CC} V _{IN} =3.4V or V _{IN} =GND	6.4	16.5 ^[11]	mA

Notes:

8. Per TTL driven input (V_{IN}=3.4V); all other inputs at V_{CC} or GND.
9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
10. I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}

$$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$$
 - I_{CC} = Quiescent Current with CMOS input levels
 - ΔI_{CC} = Power Supply Current for a TTL HIGH input (V_{IN}=3.4V)
 - D_H = Duty Cycle for TTL inputs HIGH
 - N_T = Number of TTL inputs at D_H
 - I_{CCD} = Dynamic Current caused by an input transition pair (HLH or LHL)
 - f₀ = Clock frequency for registered devices, otherwise zero
 - f₁ = Input signal frequency
 - N₁ = Number of inputs changing at f₁
11. Values for these conditions are examples of the I_C formula. These limits are specified but not tested.

Switching Characteristics Over the Operating Range^[12]

Parameter	Description	CY74FCT16373AT CY74FCT162373AT		Unit	Fig. No. ^[13]
		Min.	Max.		
t _{PLH} t _{PHL}	Propagation Delay D to O	1.5	5.2	ns	1, 3
t _{PLH} t _{PHL}	Propagation Delay LE to O	2.0	6.7	ns	1, 5
t _{PZH} t _{PZL}	Output Enable Time	1.5	6.1	ns	1, 7, 8
t _{PHZ} t _{PLZ}	Output Disable Time	1.5	5.5	ns	1, 7, 8
t _{SU}	Set-Up Time HIGH or LOW, D to LE	2.0		ns	9
t _H	Hold Time HIGH or LOW, D to LE	1.5		ns	9
t _W	LE Pulse Width HIGH	3.3		ns	5
t _{SK(O)}	Output Skew ^[14]		0.5	ns	—

Parameter	Description	CY74FCT16373CT CY74FCT162373CT		Unit	Fig. No. ^[13]
		Min.	Max.		
t _{PLH} t _{PHL}	Propagation Delay D to O	1.5	4.2	ns	1, 3
t _{PLH} t _{PHL}	Propagation Delay LE to O	2.0	5.5	ns	1, 5
t _{PZH} t _{PZL}	Output Enable Time	1.5	5.5	ns	1, 7, 8
t _{PHZ} t _{PLZ}	Output Disable Time	1.5	5.0	ns	1, 7, 8
t _{SU}	Set-Up Time HIGH or LOW, D to LE	2.0		ns	9
t _H	Hold Time HIGH or LOW, D to LE	1.5		ns	9
t _W	LE Pulse Width HIGH	3.3		ns	5
t _{SK(O)}	Output Skew ^[14]		0.5	ns	—

Notes:

12. Minimum limits are specified but not tested on Propagation Delays.
13. See "Parameter Measurement Information" in the General Information section.
14. Skew between any two outputs of the same package switching in the same direction. This parameter is ensured by design.

Ordering Information CY74FCT16373

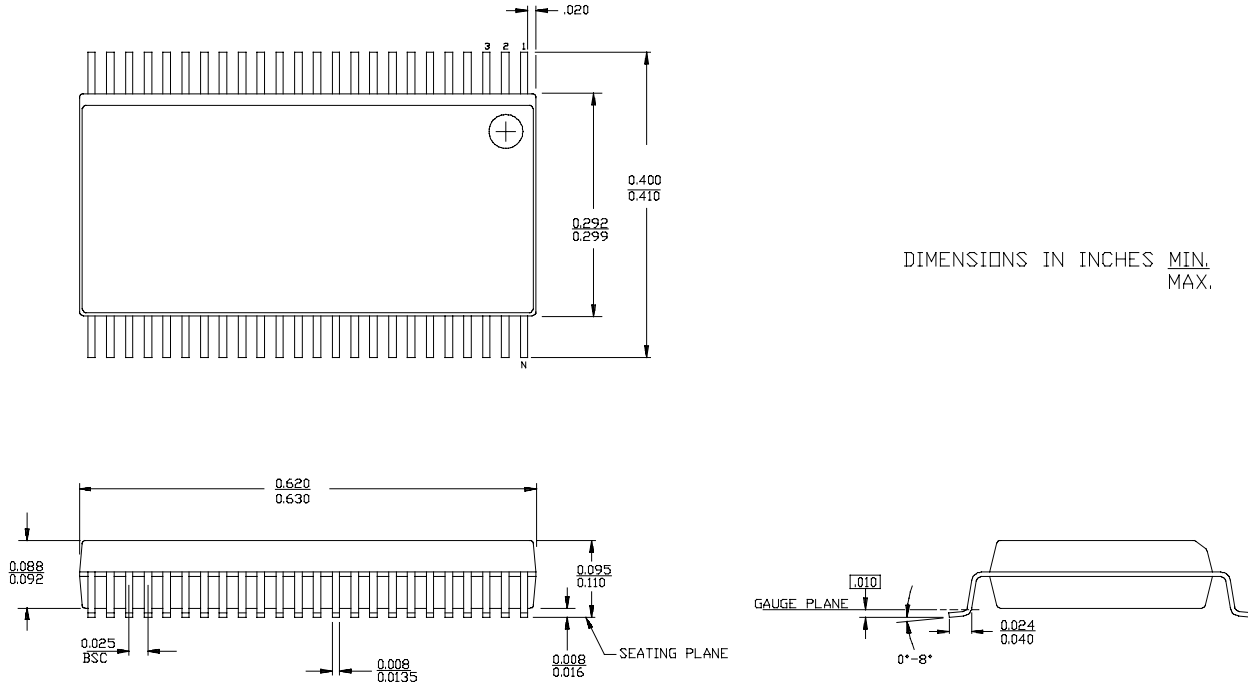
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
4.2	CY74FCT16373CTPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT16373CTPVC/PVCT	O48	48-Lead (300-Mil) SSOP	
	CY74FCT16373CTVR	-	48-Lead (173-Mil) TVSOP	
5.2	CY74FCT16373ATPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT16373ATPVC/PVCT	O48	48-Lead (300-Mil) SSOP	
	CY74FCT16373ATVR	-	48-Lead (173-Mil) TVSOP	

Ordering Information CY74FCT162373

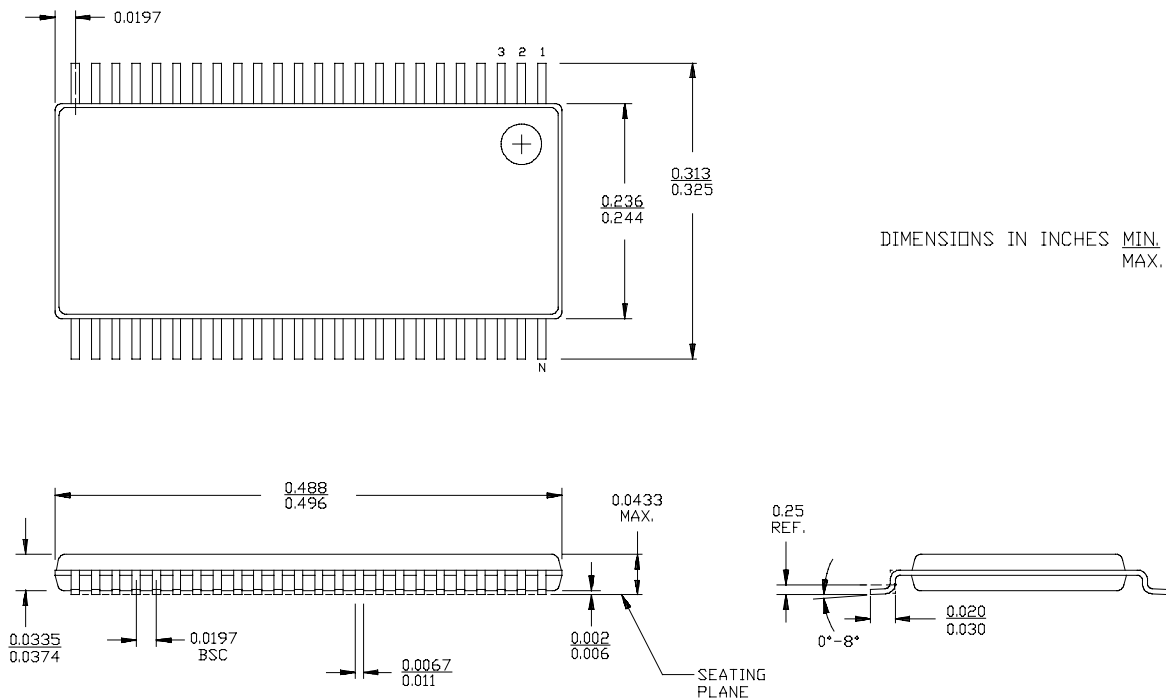
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
4.2	74FCT162373CTPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT162373CTPVC	O48	48-Lead (300-Mil) SSOP	
	74FCT162373CTPVCT	O48	48-Lead (300-Mil) SSOP	
5.2	74FCT162373ATPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT162373ATPVC	O48	48-Lead (300-Mil) SSOP	
	74FCT162373ATPVCT	O48	48-Lead (300-Mil) SSOP	

Package Diagrams

48-Lead Shrunk Small Outline Package O48



48-Lead Thin Shrunk Small Outline Package Z48



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
74FCT162373ATPACT	ACTIVE	TSSOP	DGG	48	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
74FCT162373ATPVCT	ACTIVE	SSOP	DL	48	1000	None	CU NIPDAU	Level-1-235C-UNLIM
74FCT162373CTPACT	ACTIVE	TSSOP	DGG	48	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
74FCT162373CTPVCT	ACTIVE	SSOP	DL	48	1000	None	CU NIPDAU	Level-1-235C-UNLIM
74FCT162373ETPACT	OBSOLETE	TSSOP	DGG	48		None	Call TI	Call TI
74FCT162373ETPVCT	OBSOLETE	TSSOP	DGG	48		None	Call TI	Call TI
CY74FCT162373ATPVC	ACTIVE	SSOP	DL	48	25	None	CU NIPDAU	Level-1-235C-UNLIM
CY74FCT162373CTPVC	ACTIVE	SSOP	DL	48	25	None	CU NIPDAU	Level-1-235C-UNLIM
CY74FCT162373ETPAC	OBSOLETE	TSSOP	DGG	48		None	Call TI	Call TI
CY74FCT162373ETPVC	OBSOLETE	TSSOP	DGG	48		None	Call TI	Call TI
CY74FCT16373ATPACT	ACTIVE	TSSOP	DGG	48	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CY74FCT16373ATPVC	ACTIVE	SSOP	DL	48	25	None	CU NIPDAU	Level-1-235C-UNLIM
CY74FCT16373ATPVCT	ACTIVE	SSOP	DL	48	1000	None	CU NIPDAU	Level-1-235C-UNLIM
CY74FCT16373ATVR	ACTIVE	TVSOP	DGV	48	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CY74FCT16373CTPACT	ACTIVE	TSSOP	DGG	48	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CY74FCT16373CTPVC	ACTIVE	SSOP	DL	48	25	None	CU NIPDAU	Level-1-235C-UNLIM
CY74FCT16373CTPVCT	ACTIVE	SSOP	DL	48	1000	None	CU NIPDAU	Level-1-235C-UNLIM
CY74FCT16373CTVR	ACTIVE	TVSOP	DGV	48	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
CY74FCT16373ETPAC	OBSOLETE	TSSOP	DGG	48		None	Call TI	Call TI
CY74FCT16373ETPACT	OBSOLETE	TSSOP	DGG	48		None	Call TI	Call TI
CY74FCT16373ETPVC	OBSOLETE	SSOP	DL	48		None	Call TI	Call TI
CY74FCT16373ETPVCT	OBSOLETE	SSOP	DL	48		None	Call TI	Call TI

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

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⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

DL (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 D. Falls within JEDEC MO-118

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
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 C. Body dimensions do not include mold protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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