IRFP460LC Datasheet

https://www.DiGi-Electronics.com

DiGi Electronics Part Number	IRFP460LC-DG
Manufacturer	Vishay Siliconix
Manufacturer Product Number	IRFP460LC
Description	MOSFET N-CH 500V 20A TO247-3
Detailed Description	N-Channel 500 V 20A (Tc) 280W (Tc) Through Hole TO-247AC

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Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
IRFP460LC	Vishay Siliconix
Series:	Packaging:
-	Tube
Part Status:	FET Type:
Active	N-Channel
Technology:	Drain to Source Voltage (Vdss):
MOSFET (Metal Oxide)	500 V
Current - Continuous Drain (Id) @ 25°C:	Drive Voltage (Max Rds On, Min Rds On):
20A (Tc)	10V
Rds On (Max) @ Id, Vgs:	Vgs(th) (Max) @ Id:
270mOhm @ 12A, 10V	4V @ 250µA
Gate Charge (Qg) (Max) @ Vgs:	Vgs (Max):
120 nC @ 10 V	±30V
Input Capacitance (Ciss) (Max) @ Vds:	FET Feature:
3600 pF @ 25 V	-
Power Dissipation (Max):	Operating Temperature:
280W (Tc)	-55°C ~ 150°C (TJ)
Mounting Type:	Supplier Device Package:
Through Hole	TO-247AC
Package / Case:	Base Product Number:
TO-247-3	IRFP460

Environmental & Export classification

RoHS Status:	Moisture Sensitivity Level (MSL):
RoHS non-compliant	1 (Unlimited)
ECCN:	HTSUS:
EAR99	8541.29.0095

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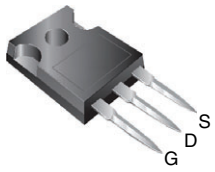
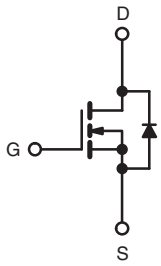
IRFP460LC

Vishay Siliconix

Power MOSFET

TO-247





N-Channel MOSFET

FEATURES

- Ultra low gate charge
- Reduced gate drive requirement
- Enhanced 30 V V_{GS} rating
- Reduced C_{iss}, C_{oss}, C_{rss}
- Isolated central mounting hole
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS* Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

DESCRIPTION

This new series of low charge Power MOSFETs achieve significantly lower gate charge over conventional MOSFETs. Utilizing advanced Power MOSFETs technology the device improvements allow for reduced gate drive requirements, faster switching speeds and increased total system savings. These device improvements combined with the proven ruggedness and reliabiltity of Power MOSFETs offer the designer a new standard in power transistors for switching applications.

The TO-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because its isolated mounting hole.

PRODUCT SUMMARY		
V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.27
Q_g (max.) (nC)	120	
Q_{gs} (nC)	32	
Q_{gd} (nC)	49	
Configuration	Single	

ORDERING INFORMATION	
Package	TO-247
Lead (Pb)-free	IRFP460LCPbF

ABSOLUTE MAXIMUM RATINGS T_C = 25 °C, unless otherwise noted

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	500	V
Gate-source voltage			V_{GS}	± 30	
Continuous drain current	V_{GS} at 10 V	T_C = 25 °C	I_D	20	A
		T_C = 100 °C		12	
Pulsed drain current [a]			I_{DM}	80	
Linear derating Factor				2.2	W/°C
Single pulse avalanche energy b			E_{AS}	960	mJ
Repetitive avalanche current[a]			I_{AR}	20	A
Repetitive avalanche energy[a]			E_{AR}	28	mJ
Maximum power dissipation	T_C = 25 °C		P_D	280	W
Peak diode recovery dV/dtc			dV/dt	3.5	V/ns
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	°C
Soldering recommendations (peak temperature)	for 10 s			300 [d]	
Mounting torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

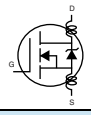
Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
b. V_{DD} = 25 V, starting T_J = 25 °C, L = 4.3 mH, R_G = 25 Ω, I_{AS} = 20 A (see fig. 12)
c. I_{SD} ≤ 20 A, dI/dt ≤ 160 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C
d. 1.6 mm from case

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	-	°C/W
Case-to-sink, flat, greased surface	R_{thCS}	0.24	-	
Maximum junction-to-case (Drain)	R_{thJC}	-	0.45	

SPECIFICATIONS T_J = 25 °C, unless otherwise noted

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	500	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.59	-	V/°C
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	2.0	-	4.0	V
Gate-source leakage	I_{GSS}	V_{GS} = ± 20 V	-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 500 V, V_{GS} = 0 V	-	-	25	µA
		V_{DS} = 400 V, V_{GS} = 0 V, T_J = 125 °C	-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V; I_D = 12 A [b]	-	-	0.27	Ω
Forward transconductance	g_{fs}	V_{DS} = 50 V, I_D = 12 A [b]	12	-	-	S
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	3600	-	pF
Output capacitance	C_{oss}		-	440	-	
Reverse transfer capacitance	C_{rss}		-	39	-	
Total gate charge	Q_g	V_{GS} = 10 V; I_D = 20 A, V_{DS} = 400 V, see fig. 6 and 13 [b]	-	-	120	nC
Gate-source charge	Q_{gs}		-	-	32	
Gate-drain charge	Q_{gd}		-	-	49	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 250 V, I_D = 20 A, R_G = 4.3 Ω, R_D = 12 Ω, see fig. 10 [b]	-	18	-	ns
Rise time	t_r		-	77	-	
Turn-off delay time	$t_{d(off)}$		-	40	-	
Fall time	t_f		-	43	-	
Internal drain inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 	-	5.0	-	nH
Internal source inductance	L_S		-	13	-	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	20	A
Pulsed diode forward current [a]	I_{SM}		-	-	80	
Body diode voltage	V_{SD}	T_J = 25 °C, I_S = 20 A, V_{GS} = 0 V [b]	-	-	1.8	V
Body diode reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 20 A, dI/dt = 100 A/µs [b]	-	570	860	ns
Body diode reverse recovery charge	Q_{rr}		-	6.6	9.9	µC
Forward turn-on time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
b. Pulse width ≤ 300 µs; duty cycle ≤ 2 %

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

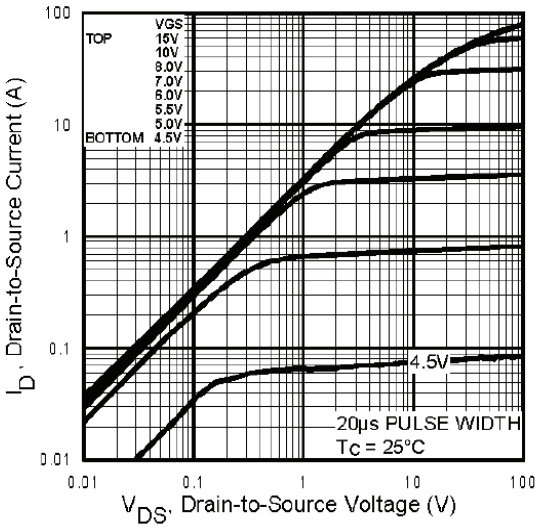


Fig. 1 - Typical Output Characteristics, T_C = 25 °C

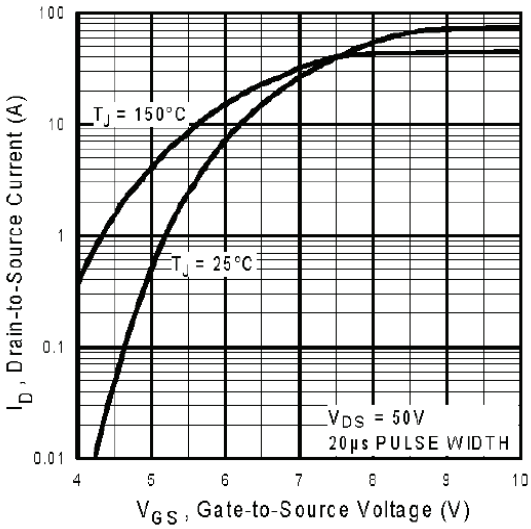


Fig. 3 - Typical Transfer Characteristics

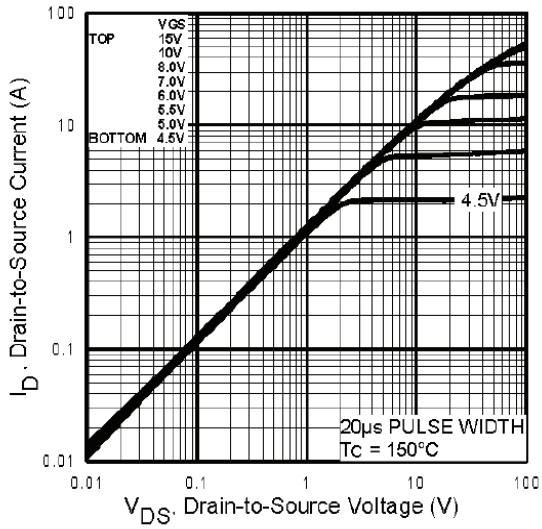


Fig. 2 - Typical Output Characteristics, T_C = 150 °C

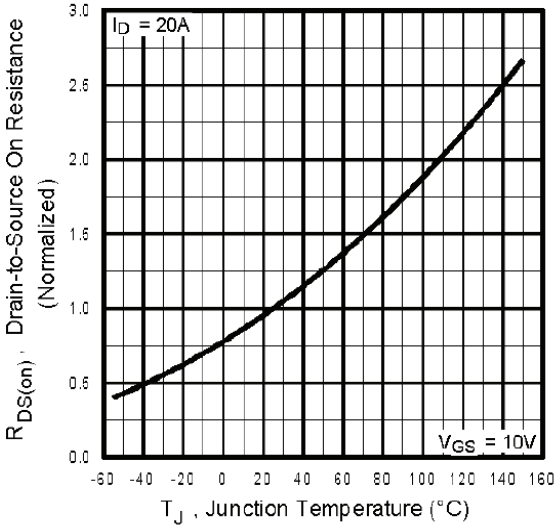


Fig. 4 - **Normalized On-Resistance vs. Temperature**

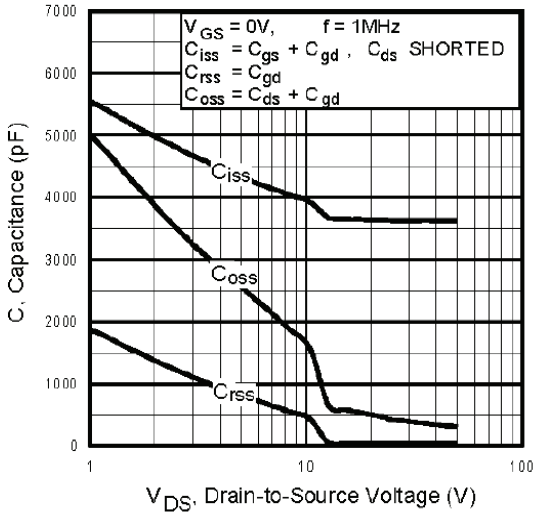


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

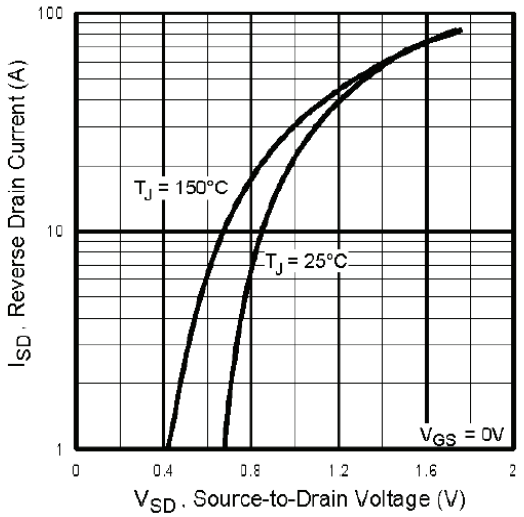


Fig. 7 - Typical Source-Drain Diode Forward Voltage

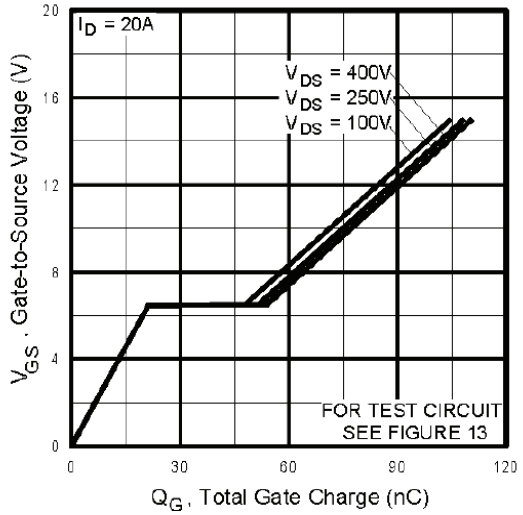


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

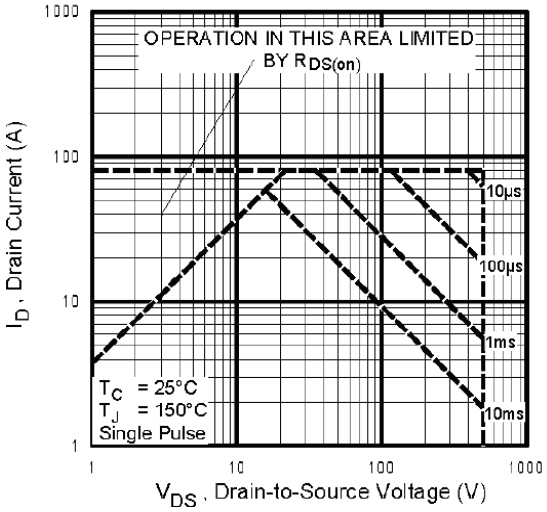


Fig. 8 - Maximum Safe Operating Area

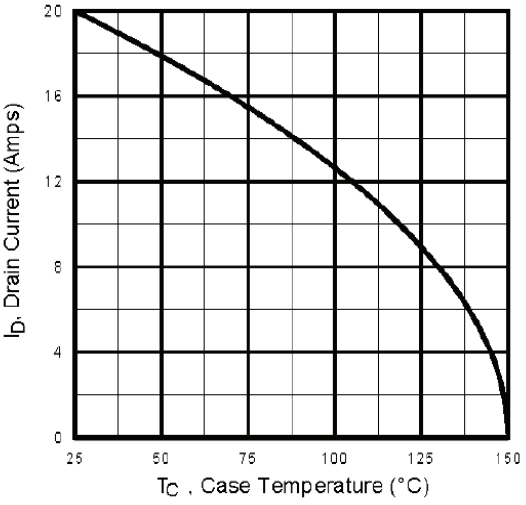


Fig. 9 - Maximum Drain Current vs. Case Temperature

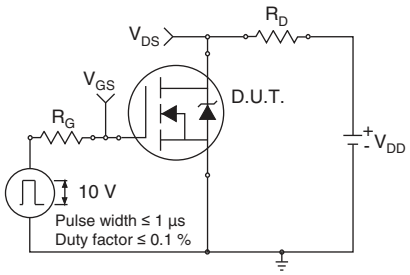


Fig. 10 - Switching Time Test Circuit

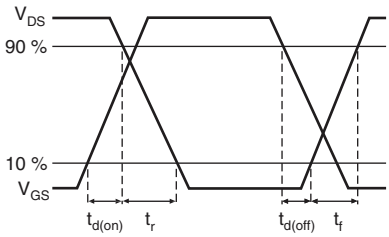


Fig. 11 - Switching Time Waveforms

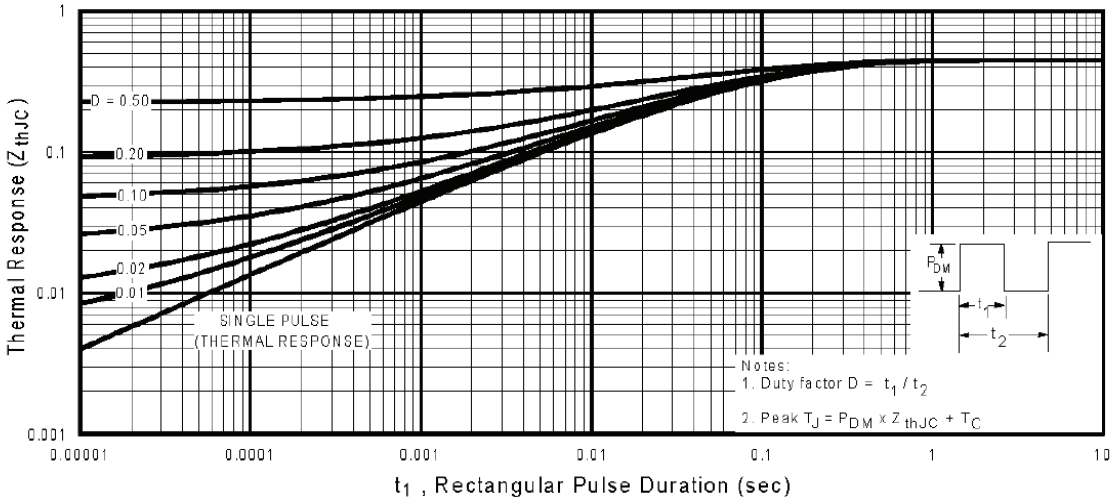


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

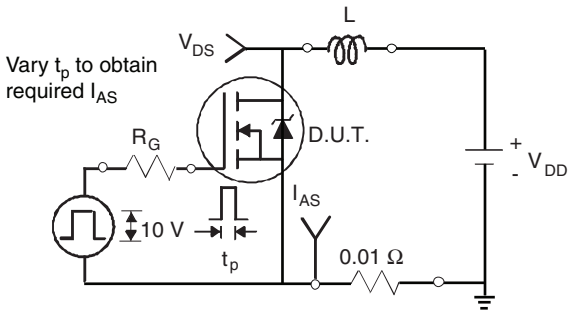


Fig. 13 - Unclamped Inductive Test Circuit

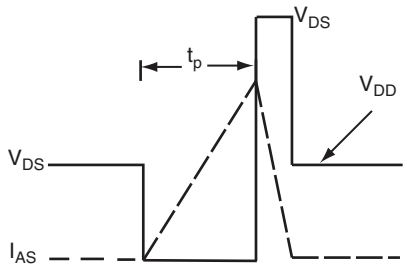


Fig. 14 - Unclamped Inductive Waveforms

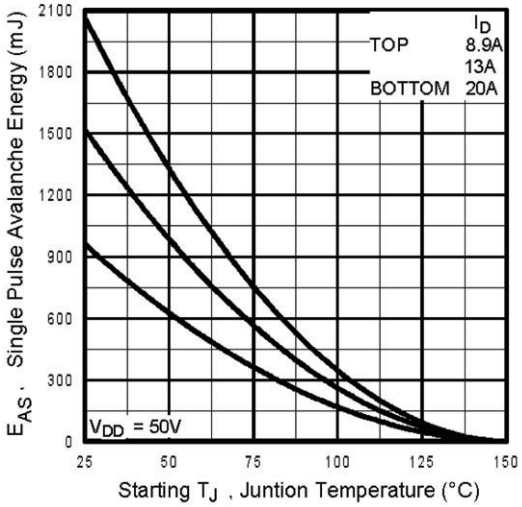


Fig. 15 - Maximum Avalanche Energy vs. Drain Current

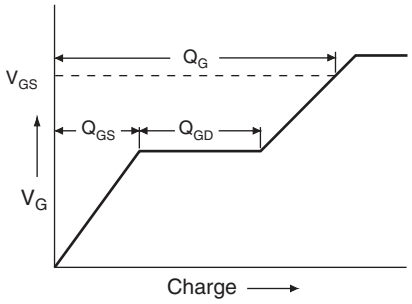


Fig. 16 - Basic Gate Charge Waveform

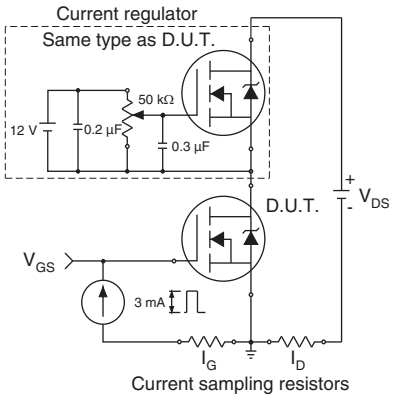
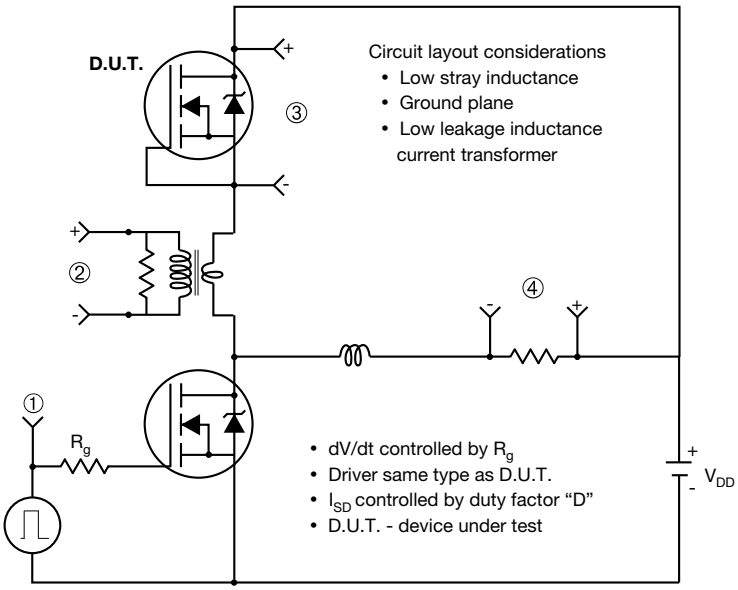
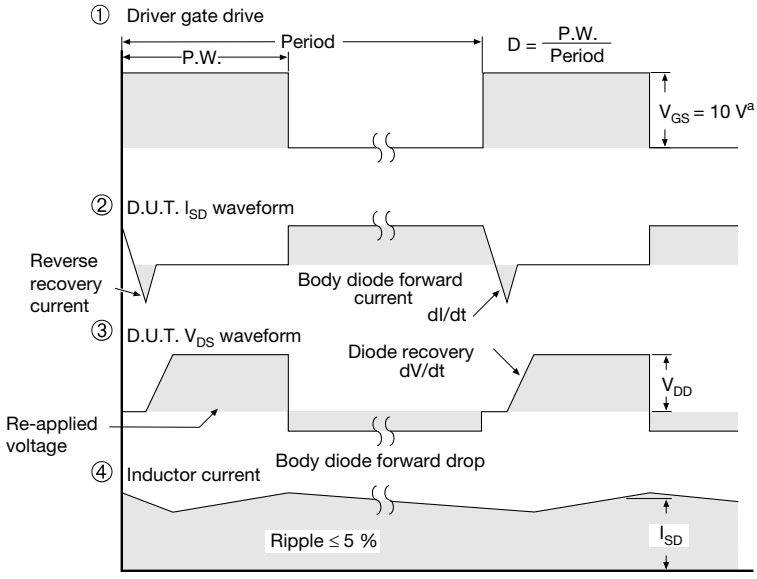


Fig. 17 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit





Note

a. V_{GS} = 5 V for logic level devices

Fig. 18 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91235.

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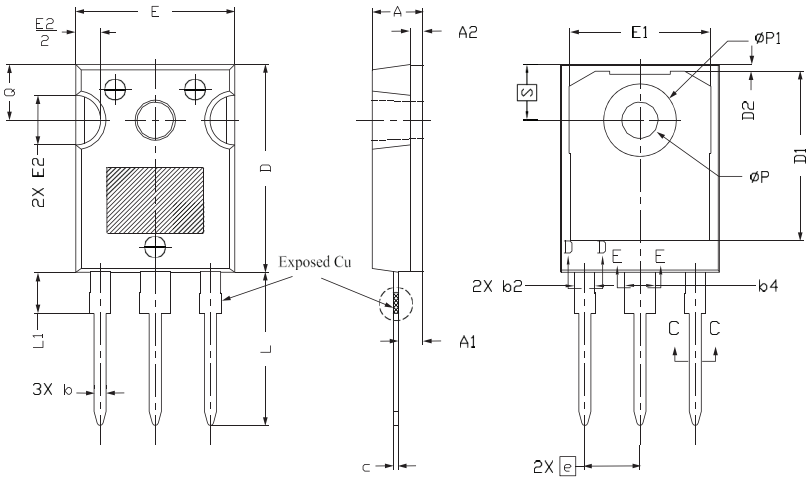
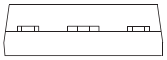
Package Information

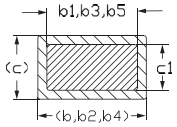
Vishay Siliconix

TO-247AC (High Voltage)

VERSION 1: FACILITY CODE = 9







Section C--C,D–D,E–E

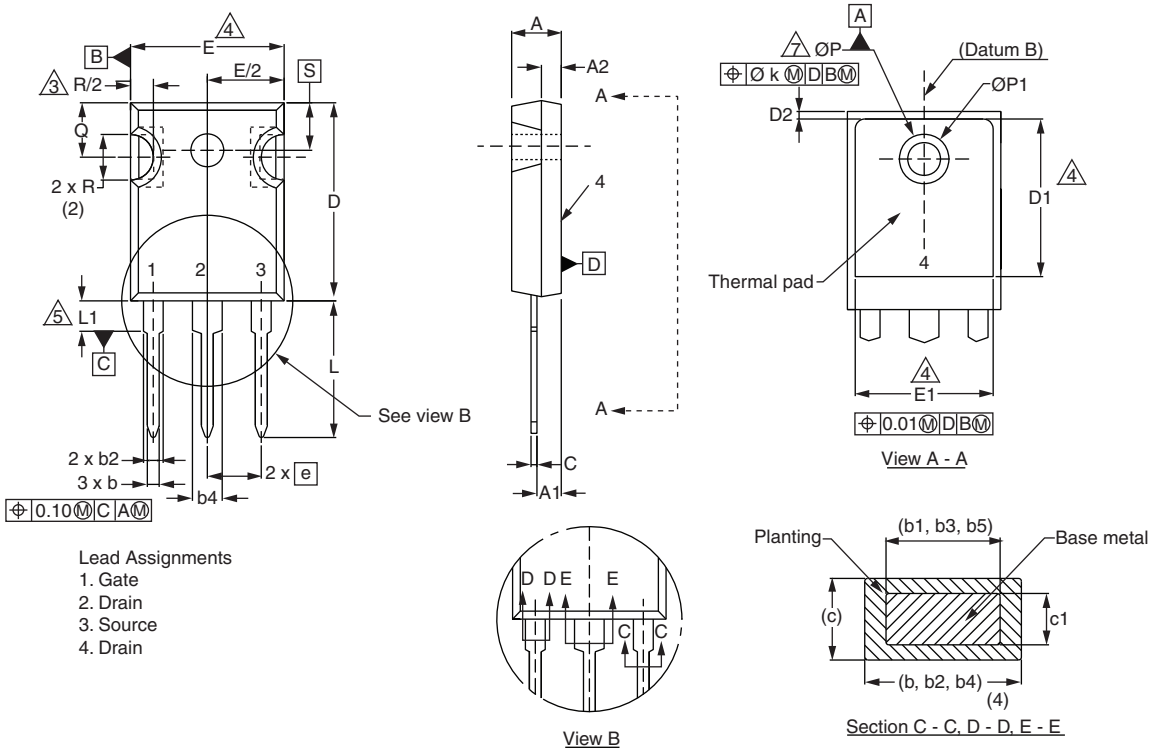
	MILLIMETERS			
DIM.	MIN.	NOM.	MAX.	NOTES
A	4.83	5.02	5.21	
A1	2.29	2.41	2.55	
A2	1.17	1.27	1.37	
b	1.12	1.20	1.33	
b1	1.12	1.20	1.28	
b2	1.91	2.00	2.39	6
b3	1.91	2.00	2.34	
b4	2.87	3.00	3.22	6, 8
b5	2.87	3.00	3.18	
c	0.40	0.50	0.60	6
c1	0.40	0.50	0.56	
D	20.40	20.55	20.70	4

	MILLIMETERS			
DIM.	MIN.	NOM.	MAX.	NOTES
D1	16.46	16.76	17.06	5
D2	0.56	0.66	0.76	
E	15.50	15.70	15.87	4
E1	13.46	14.02	14.16	5
E2	4.52	4.91	5.49	3
e	5.46 BSC			
L	14.90	15.15	15.40	
L1	3.96	4.06	4.16	6
Ø P	3.56	3.61	3.65	7
Ø P1	7.19 ref.			
Q	5.31	5.50	5.69	
S	5.51 BSC			

Notes

(1) Package reference: JEDEC® TO247, variation AC
(2) All dimensions are in mm
(3) Slot required, notch may be rounded
(4) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extremes of the plastic body
(5) Thermal pad contour optional with dimensions D1 and E1
(6) Lead finish uncontrolled in L1
(7) Ø P to have a maximum draft angle of 1.5° to the top of the part with a maximum hole diameter of 3.91 mm
(8) Dimension b2 and b4 does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of b2 and b4 dimension at maximum material condition

VERSION 2: FACILITY CODE = Y



	MILLIMETERS		
DIM.	MIN.	MAX.	NOTES
A	4.58	5.31	
A1	2.21	2.59	
A2	1.17	2.49	
b	0.99	1.40	
b1	0.99	1.35	
b2	1.53	2.39	
b3	1.65	2.37	
b4	2.42	3.43	
b5	2.59	3.38	
c	0.38	0.86	
c1	0.38	0.76	
D	19.71	20.82	
D1	13.08	-	

	MILLIMETERS		
DIM.	MIN.	MAX.	NOTES
D2	0.51	1.30	
E	15.29	15.87	
E1	13.72	-	
e	5.46 BSC		
Ø k	0.254		
L	14.20	16.25	
L1	3.71	4.29	
Ø P	3.51	3.66	
Ø P1	-	7.39	
Q	5.31	5.69	
R	4.52	5.49	
S	5.51 BSC		

Notes

(1) Dimensioning and tolerancing per ASME Y14.5M-1994

(2) Contour of slot optional

(3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body

(4) Thermal pad contour optional with dimensions D1 and E1

(5) Lead finish uncontrolled in L1

(6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")

(7) Outline conforms to JEDEC outline TO-247 with exception of dimension c

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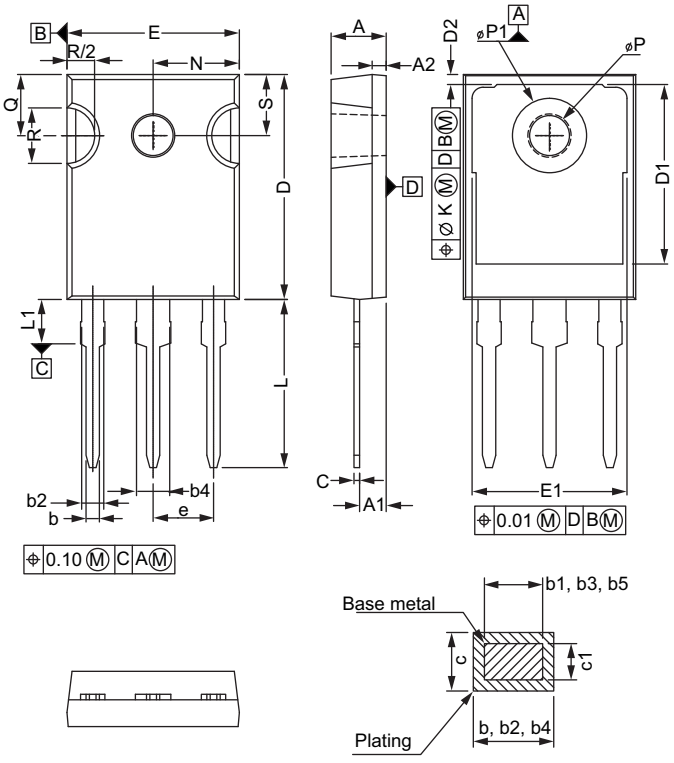
Package Information

Vishay Siliconix

VERSION 3: FACILITY CODE = N



	MILLIMETERS	
DIM.	MIN.	MAX.
A	4.65	5.31
A1	2.21	2.59
A2	1.17	1.37
b	0.99	1.40
b1	0.99	1.35
b2	1.65	2.39
b3	1.65	2.34
b4	2.59	3.43
b5	2.59	3.38
c	0.38	0.89
c1	0.38	0.84
D	19.71	20.70
D1	13.08	-

	MILLIMETERS	
DIM.	MIN.	MAX.
D2	0.51	1.35
E	15.29	15.87
E1	13.46	-
e	5.46 BSC	
k	0.254	
L	14.20	16.10
L1	3.71	4.29
N	7.62 BSC	
P	3.56	3.66
P1	-	7.39
Q	5.31	5.69
R	4.52	5.49
S	5.51 BSC	

ECN: E22-0452-Rev. G, 31-Oct-2022
DWG: 5971

Notes

(1) Dimensioning and tolerancing per ASME Y14.5M-1994
(2) Contour of slot optional
(3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
(4) Thermal pad contour optional with dimensions D1 and E1
(5) Lead finish uncontrolled in L1
(6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")

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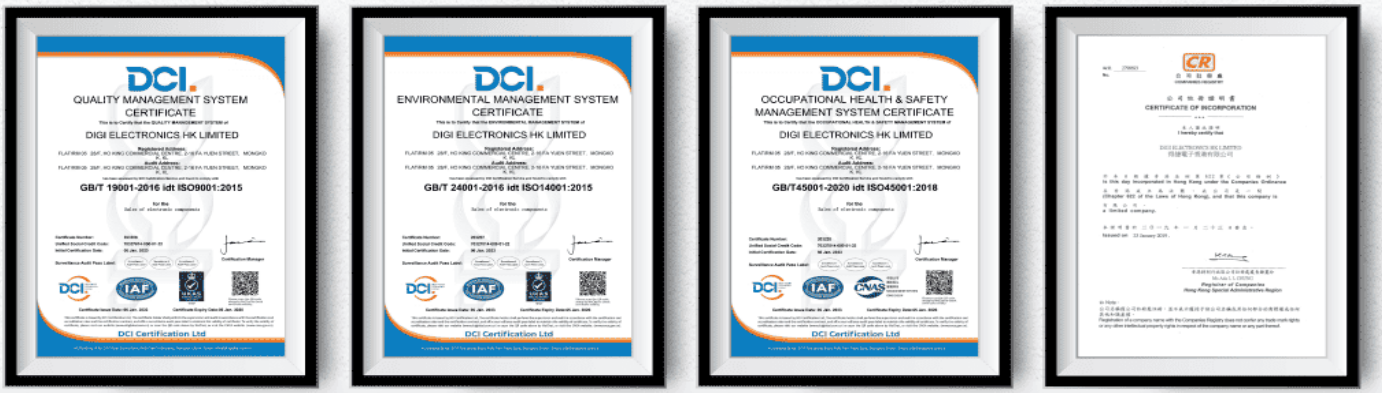

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