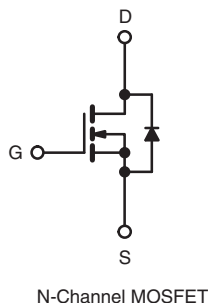
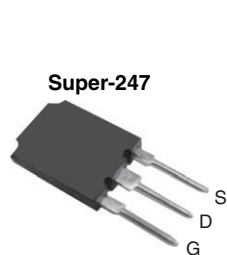


Power MOSFET



FEATURES

- Superfast body diode eliminates the need for External diodes in ZVS applications
- Lower gate charge results in simpler drive requirements
- Enhanced dV/dt capabilities offer improved ruggedness
- Higher gate voltage threshold offers improved noise immunity
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Zero voltage switching SMPS
- Telecom and server power supplies
- Uninterruptible power supplies
- Motor control applications

PRODUCT SUMMARY

V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.087
Q_g (Max.) (nC)	380	
Q_{gs} (nC)	80	
Q_{gd} (nC)	190	
Configuration	Single	

ORDERING INFORMATION

Package	Super-247
Lead (Pb)-free and halogen free	SiHFPS40N50L-GE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	500	V
Gate-source voltage	V_{GS}	± 30	
Continuous drain current	I_D	$T_C = 25\text{ }^\circ\text{C}$	A
		$T_C = 100\text{ }^\circ\text{C}$	
Pulsed drain current ^a	I_{DM}	180	
Linear derating factor		4.3	W/ $^\circ\text{C}$
Single pulse avalanche energy ^b	E_{AS}	920	mJ
Repetitive avalanche current ^a	I_{AR}	46	A
Repetitive avalanche Energy ^a	E_{AR}	54	mJ
Maximum power dissipation	P_D	540	W
Peak diode recovery dV/dt ^c	dV/dt	34	V/ns
Operating junction and storage temperature range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$
Soldering recommendations (peak temperature)	for 10 s	300 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.86\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 46\text{ A}$ (see fig. 12)
- $I_{SD} \leq 46\text{ A}$, $dI/dt \leq 550\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case


**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient ^a	R _{thJA}	-	40	°C/W
Case-to-sink, flat, greased surface	R _{thCS}	0.24	-	
Maximum junction-to-case (drain) ^a	R _{thJC}	-	0.23	

Note

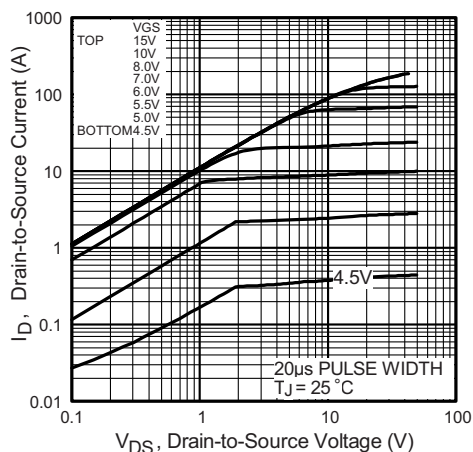
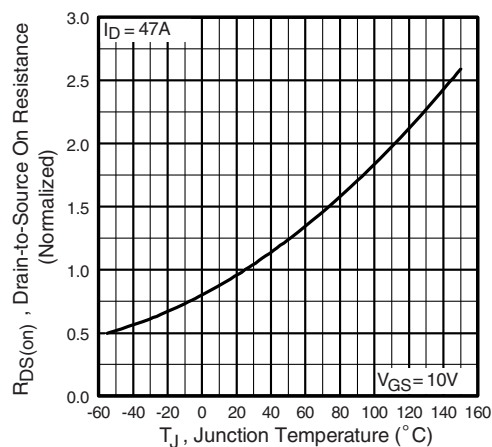
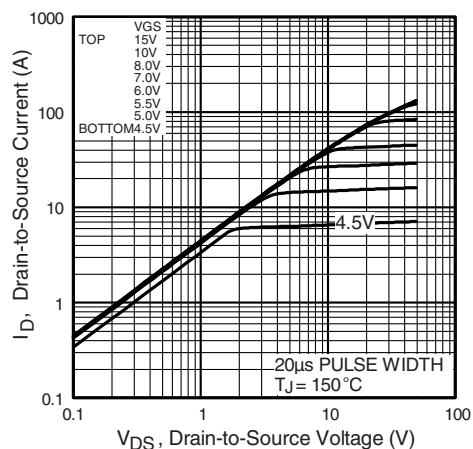
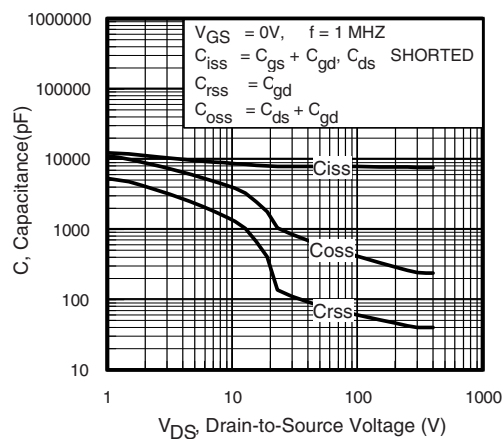
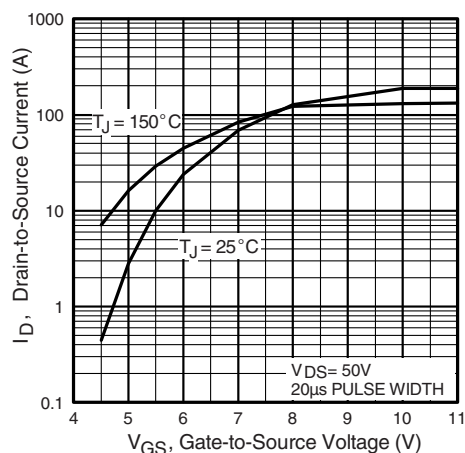
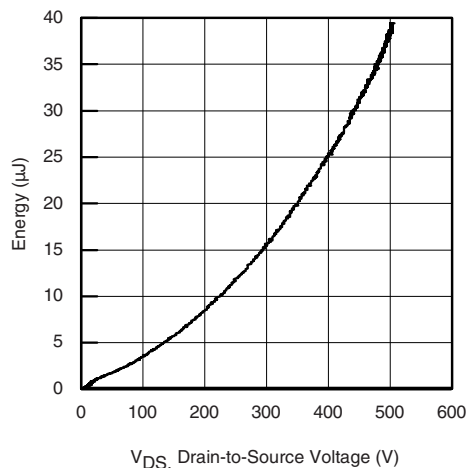
a. R_{th} is measured at T_J approximately 90 °C

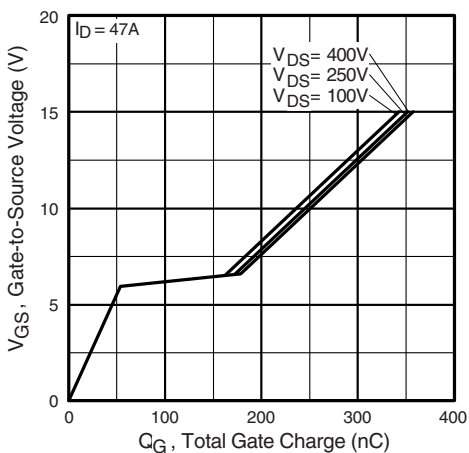
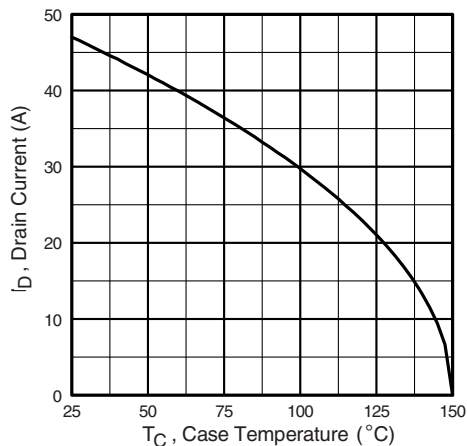
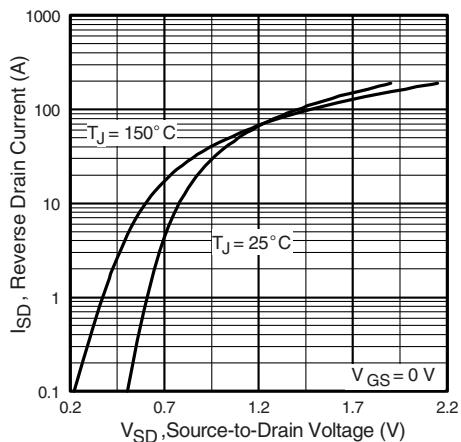
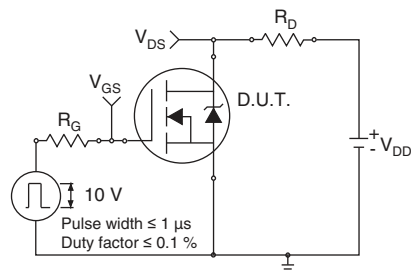
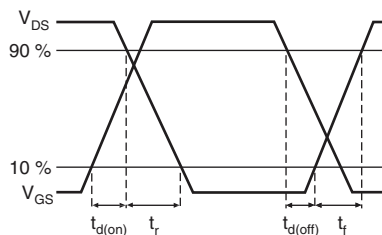
SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

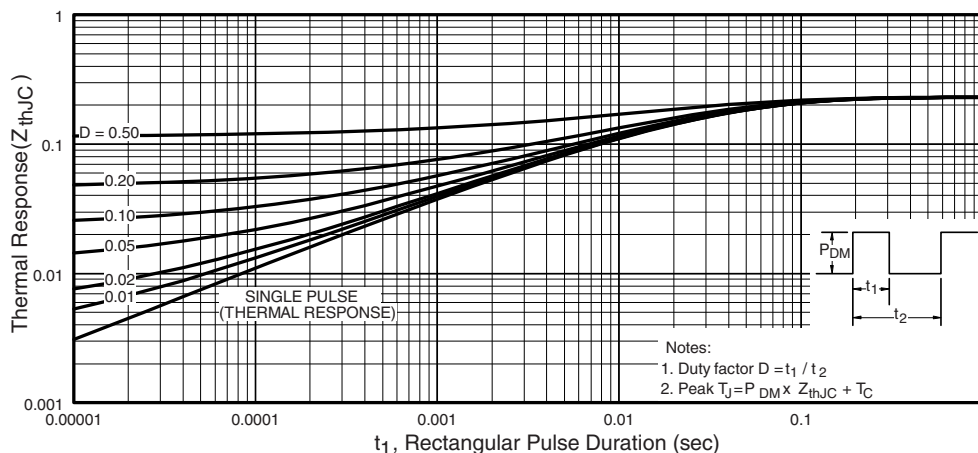
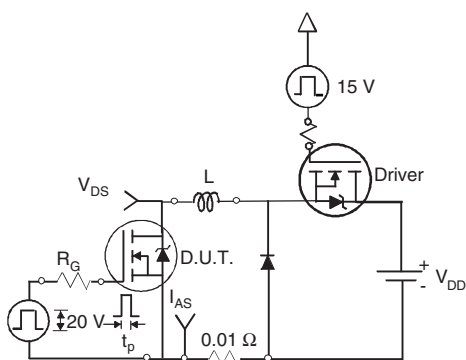
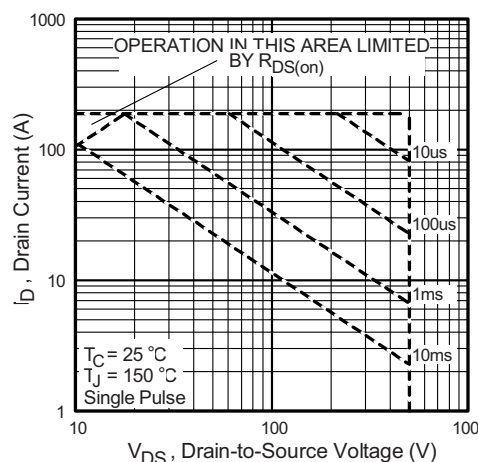
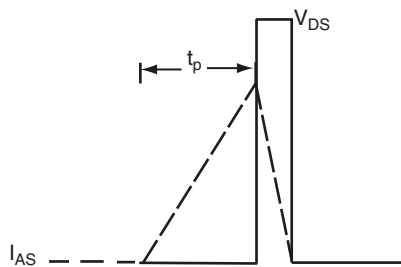
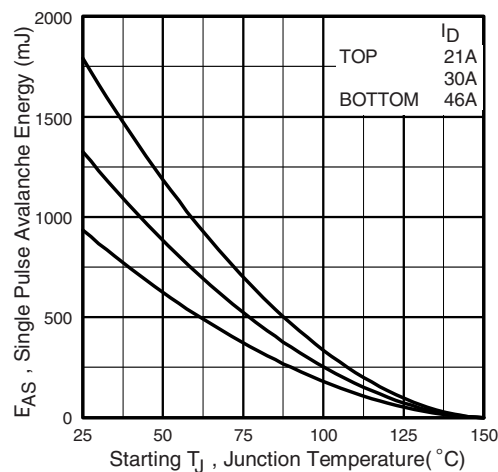
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		500	-	-	V
V _{DS} temperature coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.60	-	V/°C
Gate-source threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		3.0	-	5.0	V
Gate-source leakage	I _{GSS}	V _{GS} = ± 30 V		-	-	± 100	nA
Zero gate voltage drain current	I _{DSS}	V _{DS} = 500 V, V _{GS} = 0 V		-	-	50	μA
		V _{DS} = 400 V, V _{GS} = 0 V, T _J = 125 °C		-	-	2.0	mA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 28 A ^b	-	0.087	0.100	Ω
Forward transconductance	g _{fs}	V _{DS} = 50 V, I _D = 46 A		21	-	-	S
Dynamic							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	8110	-	pF
Output capacitance	C _{oss}			-	960	-	
Reverse transfer capacitance	C _{rss}			-	130	-	
Output capacitance	C _{oss}	V _{GS} = 0 V	V _{DS} = 1.0 V, f = 1.0 MHz	-	11200	-	pF
			V _{DS} = 400 V, f = 1.0 MHz	-	240	-	
Effective output capacitance	C _{oss eff.}		V _{DS} = 0 V to 400 V ^c	-	440	-	
Effective output capacitance (energy related)	C _{oss eff. (ER)}	-		310	-		
Total gate charge	Q _g	V _{GS} = 10 V	I _D = 46 A, V _{DS} = 400 V, see fig. 7 and 15 ^b	-	-	380	nC
Gate-source charge	Q _{gs}			-	-	80	
Gate-drain charge	Q _{gd}			-	-	190	
Internal gate resistance	R _g	f = 1 MHz, open drain		-	0.90	-	Ω
Turn-on delay time	t _{d(on)}	V _{DD} = 250 V, I _D = 46 A, R _g = 0.85 Ω, V _{GS} = 10 V, see fig. 14a and 14b ^b		-	27	-	ns
Rise time	t _r			-	170	-	
Turn-off delay time	t _{d(off)}			-	50	-	
Fall time	t _f			-	69	-	
Drain-source body diode characteristics							
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	46	A
Pulsed diode forward current ^a	I _{SM}			-	-	180	
Body diode voltage	V _{SD}	T _J = 25 °C, I _S = 46 A, V _{GS} = 0 V ^b		-	-	1.5	V
Body diode reverse recovery time	t _{rr}	T _J = 25 °C, I _F = 46 A		-	170	250	ns
		T _J = 125 °C, dI/dt = 100 A/μs ^b		-	220	330	
Body diode reverse recovery charge	Q _{rr}	T _J = 25 °C, I _S = 46 A, V _{GS} = 0 V ^b		-	705	1060	nC
		T _J = 125 °C, dI/dt = 100 A/μs ^b		-	1.3	2.0	
Reverse recovery current	I _{RRM}	T _J = 25 °C		-	9.0	-	A
Forward turn-on time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D)					

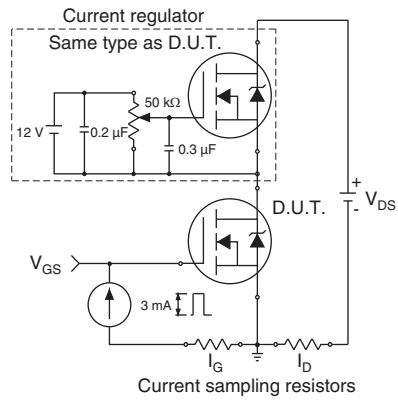
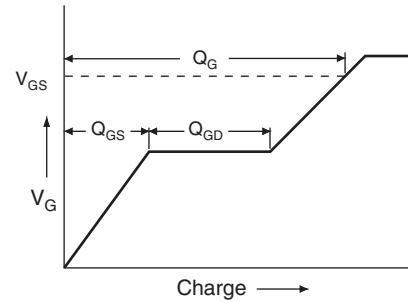
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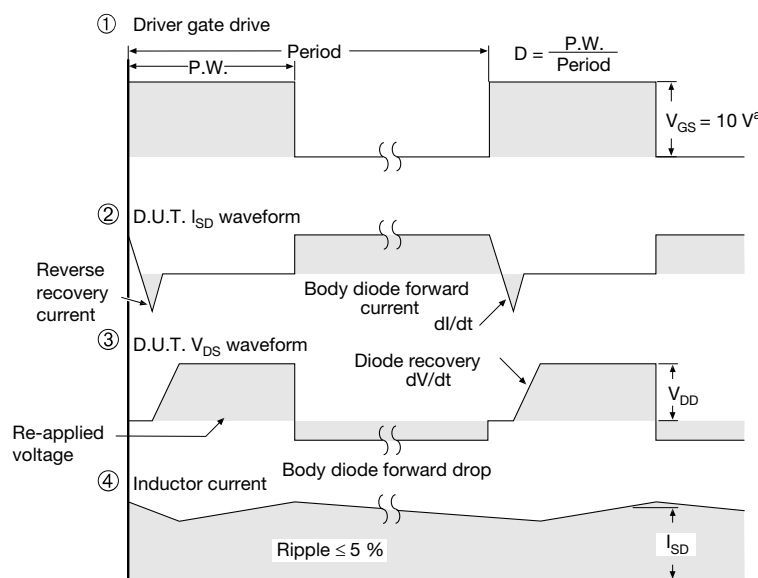
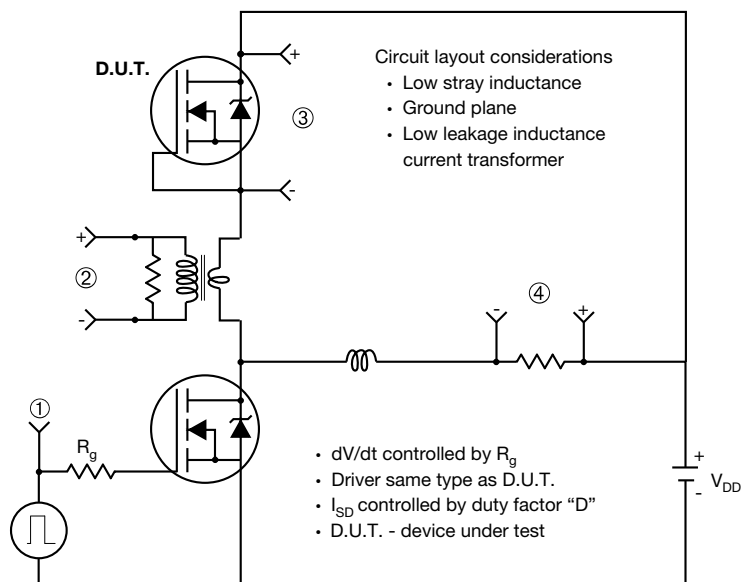
- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
b. Pulse width ≤ 400 μs; duty cycle ≤ 2 %
c. C_{oss eff.} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}
C_{oss eff. (ER)} is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 1 - Typical Output Characteristics

Fig. 4 - Normalized On-Resistance vs. Temperature

Fig. 2 - Typical Output Characteristics

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

Fig. 3 - Typical Transfer Characteristics

Fig. 6 - Typical Output Capacitance Stored Energy vs. VDS


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 8 - Typical Source Drain Diode Forward Voltage

Fig. 10a - Switching Time Test Circuit

Fig. 10b - Switching Time Waveforms


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

Fig. 12a - Unclamped Inductive Test Circuit

Fig. 12c - Maximum Avalanche Energy vs. Drain Current

Fig. 12b - Unclamped Inductive Waveforms

Fig. 12d - Maximum Safe Operating Area


Fig. 13a - Gate Charge Test Circuit

Fig. 13b - Basic Gate Charge Waveform

Peak Diode Recovery dV/dt Test Circuit

Note

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

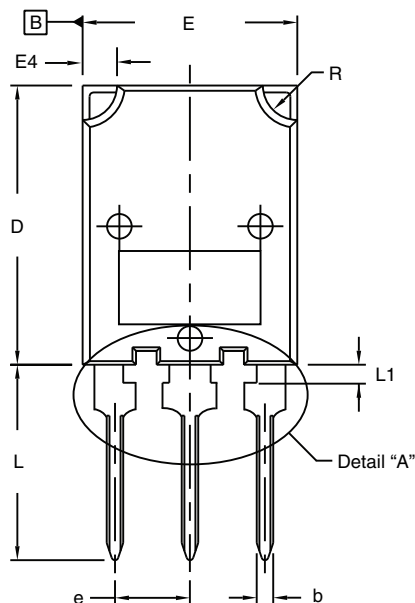
Fig. 14 - For N-Channel

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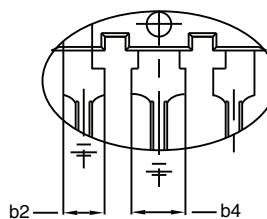
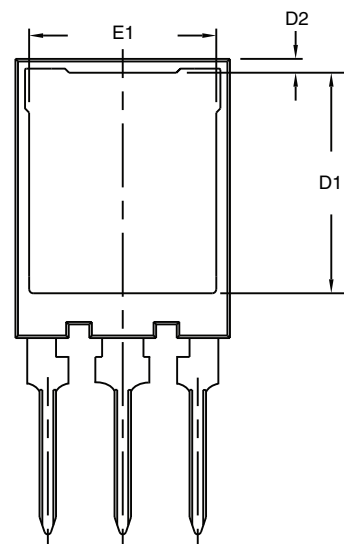
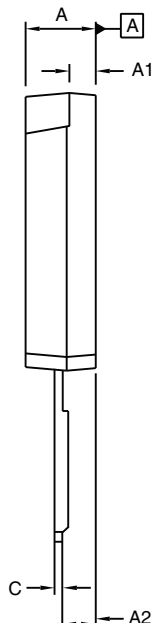
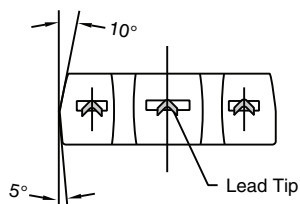


TO-274AA (High Voltage)

VERSION 1: FACILITY CODE = Y



⌀ 0.10 (0.25) ⌀ B A ⌀



Detail "A"
Scale: 2:1

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.70	5.30	0.185	0.209
A1	1.50	2.50	0.059	0.098
A2	2.25	2.65	0.089	0.104
b	1.30	1.60	0.051	0.063
b2	1.80	2.20	0.071	0.087
b4	3.00	3.25	0.118	0.128
c ⁽¹⁾	0.38	0.89	0.015	0.035
D	19.80	20.80	0.780	0.819

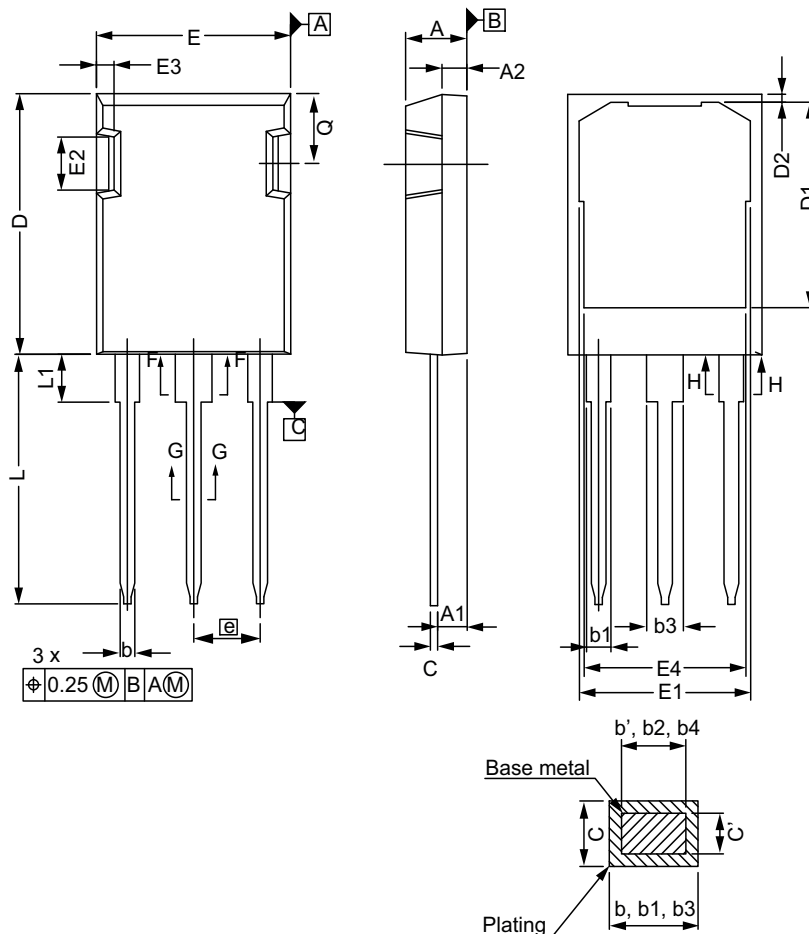
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	15.50	16.10	0.610	0.634
D2	0.70	1.30	0.028	0.051
E	15.10	16.10	0.594	0.634
E1	13.30	13.90	0.524	0.547
e	5.45 BSC		0.215 BSC	
L	13.70	14.70	0.539	0.579
L1	1.00	1.60	0.039	0.063
R	2.00	3.00	0.079	0.118

Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- 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 outer extremes of the plastic body
- Outline conforms to JEDEC® outline to TO-274AA
- (1) Dimension measured at tip of lead



VERSION 2: FACILITY CODE = N



SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

MILLIMETERS		
DIM.	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	1.91	2.41
b2	1.91	2.16
b3	2.87	3.38
b4	2.87	3.13
c'	0.55	0.65
c	0.55	0.68
D	20.80	21.10

MILLIMETERS		
DIM.	MIN.	MAX.
D1	16.25	17.65
D2	0.50	0.80
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC	
N	3	
L	19.81	20.32
L1	3.70	4.00
Q	5.49	6.00

ECN: E20-0538-Rev. C, 19-Oct-2020
DWG: 5975

Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Outline conforms to JEDEC® outline to TO-274AD
- Dimensions are measured in mm, angles are in degree
- Metal surfaces are tin plated, except area of cut



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