

Power Modules

Passivated Assembled Circuit Elements, 50A



FEATURES

- Glass passivated junctions for greater reliability
- Electrically isolated base plate
- Available up to 1600 V_{RRM}/V_{DRM}
- High dynamic characteristics
- Wide choice of circuit configurations
- Simplified mechanical design and assembly
- UL approved file E320098 

DESCRIPTION

The NP500 series of integrated power circuits consists of power thyristors and power diodes configured in a single package. With its isolating base plate, mechanical designs are greatly simplified giving advantages of cost reduction and reduced size.

Applications include power supplies, control circuits and battery chargers.



PACE-PAK (D-19 Modified)

PRODUCT SUMMARY

I_O	50A
Type	Modules - Thyristor, Standard
Package	PACE-PAK (D-19 modified)
Circuit	Single phase, hybrid bridge common cathode, Single phase, hybrid bridge doubler connection, Single phase, all SCR bridge

MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUE	UNIT
I_O	80°C	50	A
I_{TSM}, I_{FSM}	50 Hz	550	A
	60 Hz	576	
I^2t	50 Hz	1510	A^2s
	60 Hz	1380	
$I^2\sqrt{t}$		15125	$A^2\sqrt{t}$
V_{RRM}	Range	400 to 1600	V
V_{ISOL}		2500	V
T_J		-40 to 125	°C
T_{stg}			

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS			
TYPE NUMBER	V_{DRM}/V_{RRM} , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V	V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM} MAXIMUM AT T_J MAXIMUM mA
NP501/NP501W/NP501S	400	500	10
NP502/NP502W/NP502S	800	900	
NP503/NP503W/NP503S	1000	1100	
NP504/NP504W/NP504S	1200	1300	
NP505/NP505W/NP505S	1600	1700	

ON-STATE CONDUCTION						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUE	UNIT
Maximum DC output current at case temperature	I _O	Full bridge circuits			50	A
					80	°C
Maximum peak, one cycle non-reptitive on-state or forward current	I _{TSM} , I _{FSM}	t = 10ms	No voltage reapplied	Sinusoidal half wave, initial T _J = T _J maximum	550	A
		t = 8.3ms				
		t = 10ms	100%V _{RRM} reapplied		460	
		t = 8.3ms			484	
Maximum I ² t for fusing	I ² t	t = 10ms	No voltage reapplied		1510	kA ² s
		t = 8.3ms				
		t = 10ms	100%V _{RRM} reapplied		1058	
		t = 8.3ms			972	
Maximum I ² √t for fusing	I ² √t	t = 0.1 to 10 ms, no voltage reapplied I ² t for time tx = I ² √t · √t x			15125	kA ² √s
Low level value of threshold voltage	V _{T(TO)1}	(16.7 % x π x I _{T(AV)} <I< π x I _{T(AV)}), T _J = T _J maximum			0.83	V
High level value of threshold voltage	V _{T(TO)2}	(I> π x I _{T(AV)}), T _J = T _J maximum			1.03	
Low level value of on-state slope resistance	r _{t1}	(16.7 % x π x I _{T(AV)} <I< π x I _{T(AV)}), T _J = T _J maximum			9.61	mΩ
High level value of on-state slope resistance	r _{t2}	(I> π x I _{T(AV)}), T _J = T _J maximum			7.01	
Maximum on-state voltage drop	V _{TM}	I _{TM} =150A		T _J = 25 °C	1.4	V
Maximum forward voltage drop	V _{FM}	I _{FM} =150A		T _J = 25 °C	1.4	V
Maximum non-repetitive rate of rise of turned-on current	di/dt	T _J = 125 °C from 0.67 V _{DRM} I _{TM} = 150A, I _g = 500 mA, t _r < 0.5 μs, tp > 6μs			200	A/μs
Maximum holding current	I _H	T _J = 25°C anode supply = 6V, resistive load			130	mA
Maximum latching current	I _L				250	

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Maximum critical rate of rise of off-state voltage	dV/dt	$T_J = 125^{\circ}\text{C}$, exponential to $0.67 V_{\text{DRM}}$, gate open	200	V/ μs
Maximum peak reverse and off-state leakage current at V_{RRM} , V_{DRM}	I_{RRM} , I_{DRM}	$T_J = 125^{\circ}\text{C}$, gate open circuit	10	mA
Maximum peak reverse leakage current	I_{RRM}	$T_J = 25^{\circ}\text{C}$	20	μA
RMS isolation voltage	I_{ISOL}	50 Hz, circuit to base, all terminals shorted, $T_J = 25^{\circ}\text{C}$, $t = 1\text{s}$	2500	V

TRIGGERING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Maximum peak gate power	P_{GM}		8	W
Maximum average gate power	$P_{\text{G(AV)}}$		2	
Maximum peak positive gate current	I_{GM}		2	A
Maximum peak negative gate voltage	$-V_{\text{GM}}$		10	V
Maximum gate voltage required to trigger	V_{GT}	$T_J = -40^{\circ}\text{C}$	3	V
		$T_J = 25^{\circ}\text{C}$	2	
		$T_J = 125^{\circ}\text{C}$	1	
Maximum gate current required to trigger	I_{GT}	$T_J = -40^{\circ}\text{C}$	90	mA
		$T_J = 25^{\circ}\text{C}$	60	
		$T_J = 125^{\circ}\text{C}$	35	
Maximum gate voltage that will not trigger	V_{GD}	$T_J = 125^{\circ}\text{C}$, rated V_{DRM} applied	0.2	V
Maximum gate current that will not trigger	I_{GD}		2	mA

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Maximum junction operating and storage temperature range	T_J , T_{stg}		-40 to 125	$^{\circ}\text{C}$
Maximum thermal resistance, junction to case per junction	R_{thJC}	DC operation	1.00	K/W
Maximum thermal resistance, case to heatsink	R_{thCS}	Mounting surface, smooth and greased	0.10	
Mounting torque, base to heatsink ⁽¹⁾			4	Nm
Approximate weight			58	g
			2.0	oz.
Case style			PACK-PAK (D-19 modified)	

Note

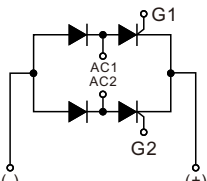
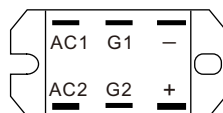
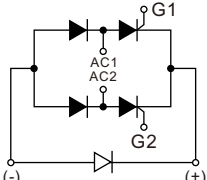
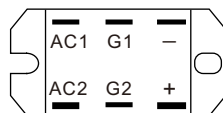
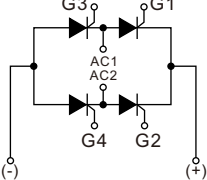
(1) A mounting compound is recommended and the torque should be checked after a period of 3 hours to allow for the spread of the compound

Ordering Information Table

Device code

N	P	50	5	W
①	②	③	④	⑤

- ① - Nell Power semiconductors product
- ② - Module type
- ③ - Current rating, 50 = 50A DC
- ④ - Voltage code
 1 = 400V 4 = 1200V
 2 = 800V 5 = 1600V
 3 = 1000V
- ⑤ - Circuit configuration
 Blank = Single Phase, Hybrid Bridge Common Cathode
 W = Single Phase, Hybrid Bridge Common Cathode with a freewheeling diode
 S = Single Phase, all SCR Bridge

CIRCUIT CONFIGURATION			
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	SCHEMATIC DIAGRAM	TERMINAL POSITIONS
Single phase, hybrid bridge common cathode	Blank		
Single phase, hybrid bridge common cathode with a freewheeling diode	W		
single phase, all SCR bridge	S		

CODING ⁽¹⁾		
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	BASIC SERIES
Single phase, hybrid bridge common cathode	Blank	NP50X
Single phase, hybrid bridge common cathode with a freewheeling diode	W	NP50XW
single phase, all SCR bridge	S	NP50XS

Note

(1) To complete code refer to voltage Ratings table, i.e.: For 1600V of NP50XW, complete code is NP505W.

Fig.1 Total Power Loss

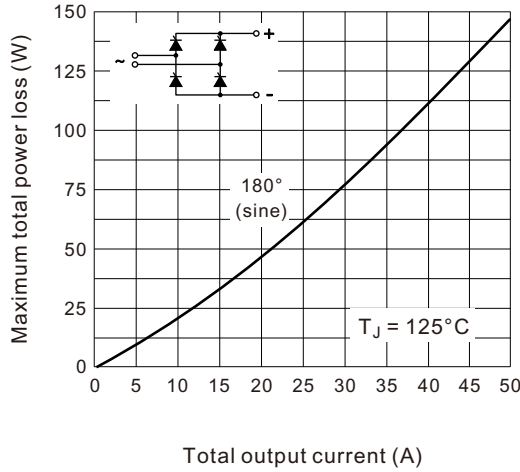


Fig.2 On-state power loss characteristics

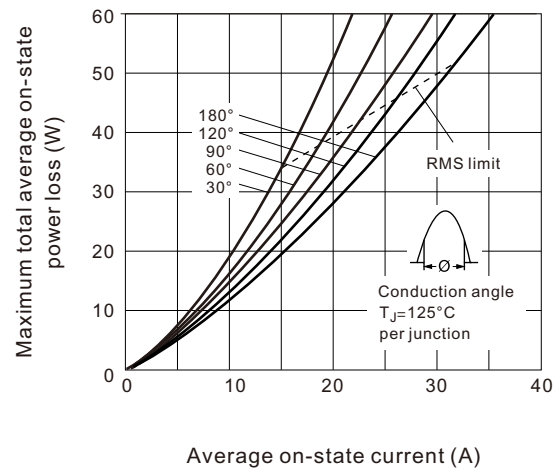


Fig.3 On-state power loss characteristics

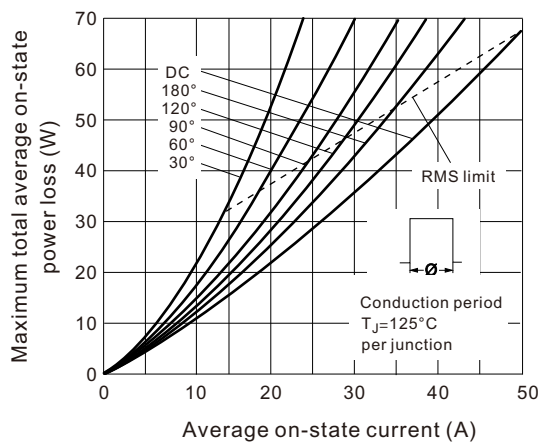


Fig.4 Current ratings characteristics

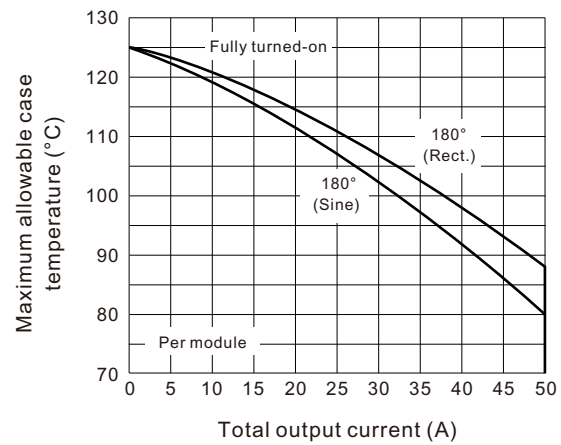


Fig.5 On-state voltage drop characteristics

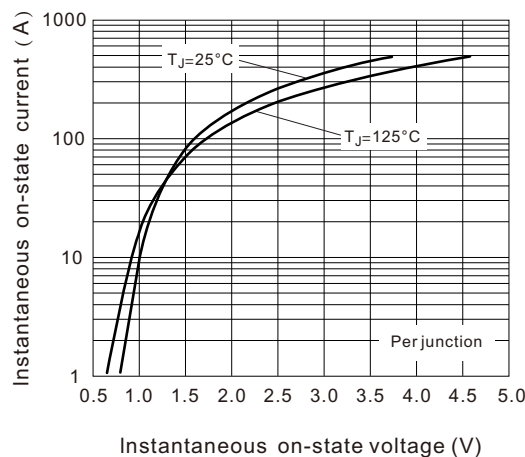


Fig.6 Maximum non-repetitive surge current

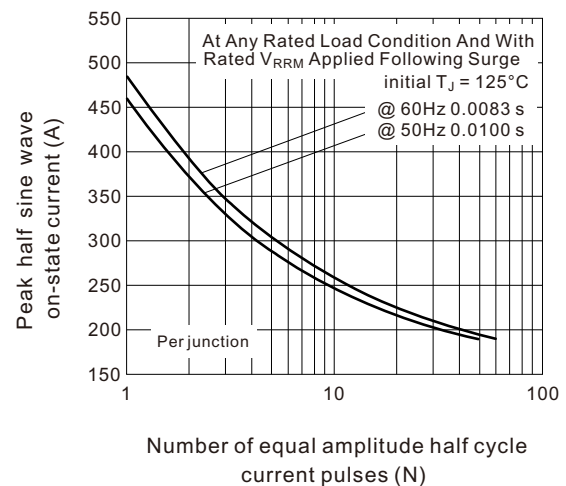


Fig.7 Maximum non-repetitive surge current

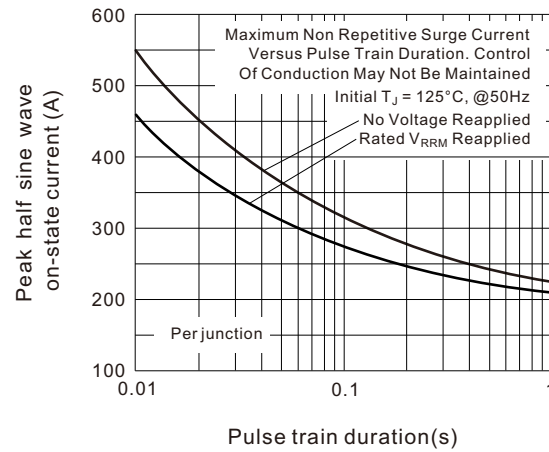


Fig.8 Thermal Impedance Z_{thJC} characteristics

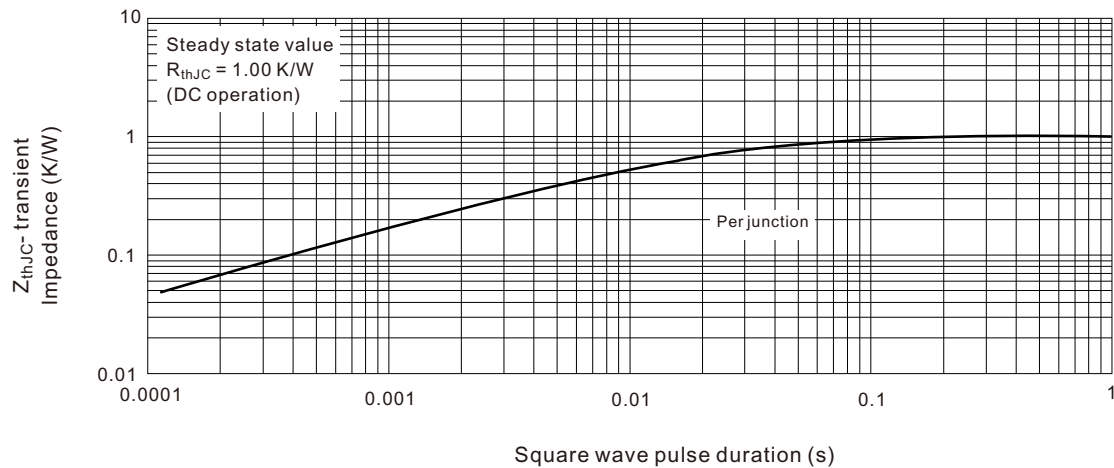
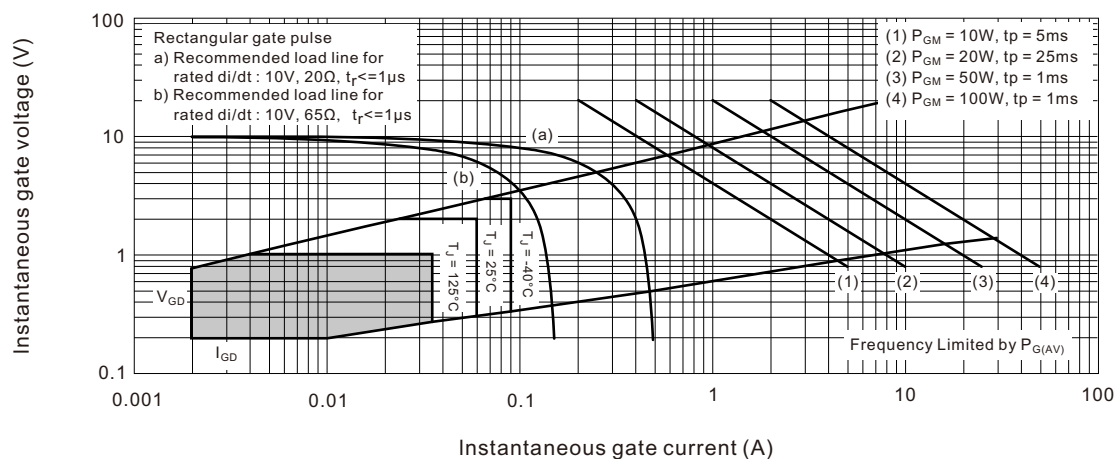


Fig.9 Gate characteristics



Technical drawing of a mechanical part, showing a top view and a side view. The top view is a rectangular plate with a central slot and four circular holes. The side view shows the profile of the plate with three vertical pins. Dimensions are given in millimeters (mm).

Top View Dimensions:

- Overall width: 63.5
- Overall height: 32.5 Max.
- Distance from top edge to centerline: 22.00
- Distance from centerline to bottom edge: 22.00
- Distance from left edge to centerline: 48.70
- Distance from centerline to right edge: 48.70
- Distance from left edge to first hole center: 22.00
- Distance from first hole center to second hole center: 22.00
- Distance from second hole center to third hole center: 22.00
- Distance from third hole center to right edge: 22.00
- Distance from centerline to first hole center: 22.00
- Distance from centerline to second hole center: 22.00
- Distance from centerline to third hole center: 22.00
- Distance from centerline to fourth hole center: 22.00
- Distance from centerline to fifth hole center: 22.00
- Distance from centerline to sixth hole center: 22.00
- Distance from centerline to seventh hole center: 22.00
- Distance from centerline to eighth hole center: 22.00
- Distance from centerline to ninth hole center: 22.00
- Distance from centerline to tenth hole center: 22.00
- Distance from centerline to eleventh hole center: 22.00
- Distance from centerline to twelfth hole center: 22.00
- Distance from centerline to thirteenth hole center: 22.00
- Distance from centerline to fourteenth hole center: 22.00
- Distance from centerline to fifteenth hole center: 22.00
- Distance from centerline to sixteenth hole center: 22.00
- Distance from centerline to seventeenth hole center: 22.00
- Distance from centerline to eighteenth hole center: 22.00
- Distance from centerline to nineteenth hole center: 22.00
- Distance from centerline to twentieth hole center: 22.00
- Distance from centerline to twenty-first hole center: 22.00
- Distance from centerline to twenty-second hole center: 22.00
- Distance from centerline to twenty-third hole center: 22.00
- Distance from centerline to twenty-fourth hole center: 22.00
- Distance from centerline to twenty-fifth hole center: 22.00
- Distance from centerline to twenty-sixth hole center: 22.00
- Distance from centerline to twenty-seventh hole center: 22.00
- Distance from centerline to twenty-eighth hole center: 22.00
- Distance from centerline to twenty-ninth hole center: 22.00
- Distance from centerline to thirtieth hole center: 22.00
- Distance from centerline to thirty-first hole center: 22.00
- Distance from centerline to thirty-second hole center: 22.00
- Distance from centerline to thirty-third hole center: 22.00
- Distance from centerline to thirty-fourth hole center: 22.00
- Distance from centerline to thirty-fifth hole center: 22.00
- Distance from centerline to thirty-sixth hole center: 22.00
- Distance from centerline to thirty-seventh hole center: 22.00
- Distance from centerline to thirty-eighth hole center: 22.00
- Distance from centerline to thirty-ninth hole center: 22.00
- Distance from centerline to fortieth hole center: 22.00
- Distance from centerline to forty-first hole center: 22.00
- Distance from centerline to forty-second hole center: 22.00
- Distance from centerline to forty-third hole center: 22.00
- Distance from centerline to forty-fourth hole center: 22.00
- Distance from centerline to forty-fifth hole center: 22.00
- Distance from centerline to forty-sixth hole center: 22.00
- Distance from centerline to forty-seventh hole center: 22.00
- Distance from centerline to forty-eighth hole center: 22.00
- Distance from centerline to forty-ninth hole center: 22.00
- Distance from centerline to fiftieth hole center: 22.00

Side View Dimensions:

- Overall width: 53.0
- Overall height: 17.0
- Distance from top edge to centerline: 10.5
- Distance from centerline to bottom edge: 10.5
- Distance from left edge to centerline: 25.40
- Distance from centerline to right edge: 25.40
- Distance from left edge to first hole center: 11.70
- Distance from first hole center to second hole center: 11.70
- Distance from second hole center to third hole center: 11.70
- Distance from third hole center to right edge: 11.70
- Distance from centerline to first hole center: 11.70
- Distance from centerline to second hole center: 11.70
- Distance from centerline to third hole center: 11.70
- Distance from centerline to fourth hole center: 11.70
- Distance from centerline to fifth hole center: 11.70
- Distance from centerline to sixth hole center: 11.70
- Distance from centerline to seventh hole center: 11.70
- Distance from centerline to eighth hole center: 11.70
- Distance from centerline to ninth hole center: 11.70
- Distance from centerline to tenth hole center: 11.70
- Distance from centerline to eleventh hole center: 11.70
- Distance from centerline to twelfth hole center: 11.70
- Distance from centerline to thirteenth hole center: 11.70
- Distance from centerline to fourteenth hole center: 11.70
- Distance from centerline to fifteenth hole center: 11.70
- Distance from centerline to sixteenth hole center: 11.70
- Distance from centerline to seventeenth hole center: 11.70
- Distance from centerline to eighteenth hole center: 11.70
- Distance from centerline to nineteenth hole center: 11.70
- Distance from centerline to twentieth hole center: 11.70
- Distance from centerline to twenty-first hole center: 11.70
- Distance from centerline to twenty-second hole center: 11.70
- Distance from centerline to twenty-third hole center: 11.70
- Distance from centerline to twenty-fourth hole center: 11.70
- Distance from centerline to twenty-fifth hole center: 11.70
- Distance from centerline to twenty-sixth hole center: 11.70
- Distance from centerline to twenty-seventh hole center: 11.70
- Distance from centerline to twenty-eighth hole center: 11.70
- Distance from centerline to twenty-ninth hole center: 11.70
- Distance from centerline to thirtieth hole center: 11.70
- Distance from centerline to thirty-first hole center: 11.70
- Distance from centerline to thirty-second hole center: 11.70
- Distance from centerline to thirty-third hole center: 11.70
- Distance from centerline to thirty-fourth hole center: 11.70
- Distance from centerline to thirty-fifth hole center: 11.70
- Distance from centerline to thirty-sixth hole center: 11.70
- Distance from centerline to thirty-seventh hole center: 11.70
- Distance from centerline to thirty-eighth hole center: 11.70
- Distance from centerline to thirty-ninth hole center: 11.70
- Distance from centerline to fortieth hole center: 11.70
- Distance from centerline to forty-first hole center: 11.70
- Distance from centerline to forty-second hole center: 11.70
- Distance from centerline to forty-third hole center: 11.70
- Distance from centerline to forty-fourth hole center: 11.70
- Distance from centerline to forty-fifth hole center: 11.70
- Distance from centerline to forty-sixth hole center: 11.70
- Distance from centerline to forty-seventh hole center: 11.70
- Distance from centerline to forty-eighth hole center: 11.70
- Distance from centerline to forty-ninth hole center: 11.70
- Distance from centerline to fiftieth hole center: 11.70

Callouts:

- Ø 5.4 (Hole diameter)
- C 2.0 (Chamfer)
- Ø 1.65 (typ.) (Pin diameter)
- C 1.0 (Chamfer)
- 6.35 (typ.) (Pin length)
- 3.0 (Pin height)
- 1.5 (Pin width)
- 10.5 (Pin height)
- 17.0 (Pin height)
- 4.5 (Pin height)
- 5.7 (Pin height)
- 0.8 (Pin height)

All dimensions in millimeters